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GROUND-WATER RESOURCES OF CENTRAL AND SOUTHERN YORK COUNTY, PENNSYLVANIA

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by Orville B. Lloyd, Jr., and Douglas J. Growitz
U. S. Geological Survey

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PREFACE

This report on subsurface water resources of central and southern York County provides valuable information which can be of assistance and benefit to all who are concerned and involved with water resources planning and development in that rapidly developing area of south-central Pennsylvania. Both the population growth and the commercial expansion occurring in the area must be supported by a comparable increase in water supplies. Subsurface water resources offer an excellent supply of underdeveloped, quality water.

The central and southern York County area is underlain by a considerable variety of rock types, all involved in extremely complex structural configurations. As a result of these complexities, the availability and quality of ground-water resources in the area varies from place to place. This report will assist planners, developers, and property owners in adjusting their water supply plans to the local conditions in the area. Water well drillers will benefit from the guidance in selecting favorable well sites, predicting yields, determining optimum drilling depths, and anticipating water quality.

All prospective beneficiaries of this water report are urged to utilize it to the fullest. Wise use of our good water resources will not only save money, but will also protect its quality and prolong its availability to the largest possible number of our citizens.

Arthur A. Socolow

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GROUND-WATER RESOURCES OF CENTRAL AND SOUTHERN YORK COUNTY, PENNSYLVANIA

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ABSTRACT

The area of investigation is in the Conestoga Valley and Piedmont Uplands sections of the Piedmont province in Pennsylvania. The major bedrock units underlying the area are early Paleozoic or Precambrian in age and consist of the Conestoga, Ledger, Kinzers, and Vintage Formations, which are chiefly carbonate rocks; the Antietam, Chickies, and Harpers Formations; the Marburg Schist and the albite-chlorite schist and metavolcanics of the Wissahickon Formation; the Peters Creek Schist; and the Peach Bottom Slate. Most of these rocks are blanketed with regolith.

Specific capacities of wells are affected principally by rock type, topography, depth and yield of water-bearing zones, and by pumping rate and duration of pumping. From the specific capacities of wells in the bedrock aquifers it is estimated that 25 percent of the wells should produce 400 gpm (gallons per minute), or 25 l/s (liters per second), from the Ledger Formation; 140 gpm (8.8 l/s) from the Conestoga Formation; about 50 to 100 gpm (3.2 to 6.3 l/s) from the Chickies and Vintage Formations, the albite-chlorite schist and metavolcanics of the Wissahickon Formation, the Peters Creek Schist, and the shale of the Kinzers Formation; and less than 25 gpm (1.6 l/s) from the Antietam and Harpers Formations, the Marburg Schist, and limestones of the Kinzers Formation.

In general the water in the carbonate-rock aquifers has a hardness of about 13 gpg (grains per gallon), or 220 mg/l (milligrams per liter), and a pH of 7.0. Water in the noncarbonates has a hardness of about 3 gpg (50 mg/l) and a pH of 5.9.

The occurrence of nitrate is common in water sampled from the albite-chlorite schist and metavolcanics of the Wissahickon Formation, Marburg Schist, Peach Bottom Slate, and Peters Creek Schist. Nitrate concentrations that exceed 45 mg/l were found in water sampled from the Conestoga and Harpers Formations; the Marburg Schist and the albite-chlorite schist and metavolcanics of the Wissahickon Formation; and the limestones of the Kinzers Formation.

Seasonal fluctuations occur in the quality of water from wells in the albite-chlorite schist and metavolcanics of the Wissahickon Formation, and such changes probably occur in water from wells in other rocks throughout the area.

Average annual precipitation in the area is about 41 inches (104 cm). Evapotranspiration consumes about 27 inches (69 cm) of the average annual precipitation, and the remaining 14 inches (36 cm) leaves the area as streamflow. About two thirds of the water that constitutes streamflow has infiltrated downward through the soil to the water table and then moved downward and laterally through pore spaces, fractures, and solution openings to the streams.

INTRODUCTION

GENERAL SETTING

The area of investigation is in central and southern York County and southeastern Adams County and comprises approximately 650 square miles (1,680 km^2). It is bounded on the east by the Susquehanna River, on the south by the Pennsylvania-Maryland state line, and on the north and west by a geologic and physiographic boundary—the southeastern edge of the Triassic Lowlands (Figure 1).

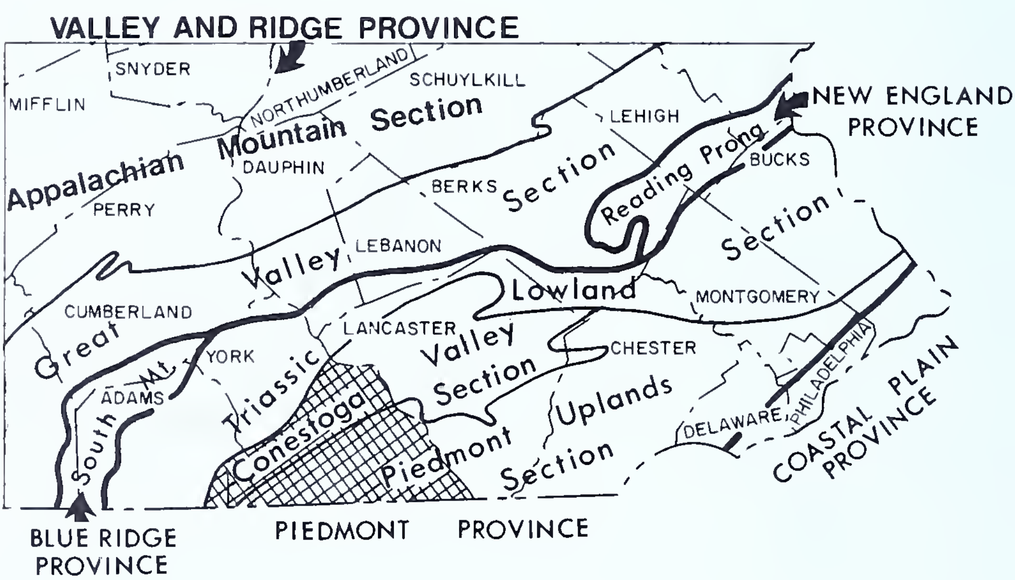


Figure 1. Map of southeastern Pennsylvania showing physiographic divisions and the location of the area of this investigation (shaded).

Approximately 70 percent of the study area is still farmed, but it is one of the major and fast-growing marketing and industrial areas in Pennsylvania. An increasing demand for sufficient quantities of good-quality water must be planned for and eventually met to assure the continued prosperity and future growth of the area. This commitment requires knowledge and evaluation of both the surface- and ground-water resources of the area.

Ground water in the area serves as a source for rural-domestic water supply and small-community water supply and supplies the major part of the water that is used by the cities of York and Hanover and their suburban areas.

PURPOSE AND SCOPE

The purpose of this report is to evaluate the significance, availability, and quality of the ground-water resources in the major bedrock formations underlying the study area.

This investigation was done as part of the continuing study of the ground-water resources of Pennsylvania by the U. S. Geological Survey in cooperation with the Pennsylvania Department of Environmental Resources, Bureau of Topographic and Geologic Survey.

METHODS OF INVESTIGATION

More than 600 domestic, municipal, and industrial wells were inventoried for this study. The emphasis during the inventory was on obtaining information from wells that were so distributed as to provide adequate areal coverage of the major bedrock units. Information such as well depth, amount of casing, and reported yield was generally available from drillers' records. In addition, the authors made 255 aquifer tests (generally 1 hour in duration), collected 91 samples of ground water for chemical analysis in the laboratory, and made approximately 400 determinations of hardness (in grains per gallon), pH, specific conductance, and temperature of the water in the field.

In order to monitor the magnitude of seasonal fluctuations of the water table, continuous water-level recorders were maintained in four observation wells (Yo-230, 234, 241, and 243) from November 1968 to December 1970. A continuous recording stream gage, a precipitation gage, and a network of 35 observation wells were established and maintained from November 1968 to December 1970 to determine the amount and routing of water entering and leaving Muddy Creek basin. Four of the observation wells were equipped with continuous water-level recorders. Water levels

in the remaining 31 wells were measured during a 1-day period at monthly intervals.

Fracture traces were mapped on aerial photographs of the area. Five test wells were drilled along fracture traces to determine if these features are surface expressions of zones of high permeability in the bedrock.

PREVIOUS INVESTIGATIONS

The geology of parts of the area of this investigation has been described in reports by Knopf and Jonas (1929) and Stose and Stose (1944). The geology of Adams County and York County has been mapped and described in detail by Stose (1932) and Stose and Jonas (1939), respectively.

The ground-water resources of the area were described very briefly by Hall (1934). The general hydrologic characteristics of the 19 different rock formations of the area were summarized in five categories by Bourquard and Associates (1962) and Bourquard, Geil, and Associates (1962).

ACKNOWLEDGEMENTS

The writers are grateful to the many well owners and operators of municipal water works who supplied information about their wells and allowed pumping tests to be performed on, and water samples collected from, the wells. Access to the records of the following well drillers is greatly appreciated: A. C. Reider and Son of Dallastown, York Drilling Company of York, and Kohl Brothers of Harrisburg. Mr. Eugene Blevins and Mr. Irving Naylor allowed test wells to be drilled on their property. The writers are also grateful for the early direction given the project by Herbert E. Johnston.

WELL-NUMBERING SYSTEM

The well-numbering system consists of a county abbreviation (Ad for Adams and Yo for York) and a number. The numbers are listed in sequence in Table 17; missing numbers have been assigned to wells in parts of the counties that are not included in the study area. Latitude-longitude locations are given to the nearest minute in the well records in Table 17, and the well locations are shown on Plate 1.

TOPOGRAPHY AND DRAINAGE

The area of investigation is in the Conestoga Valley and Piedmont Uplands sections of the Piedmont physiographic province (Figure 1). The

Conestoga Valley section includes a relatively flat central valley and two prominent hill areas on the northwest edge of the section—the Pigeon Hills north of Hanover and the Hellam Hills northeast of York. The land rises southward to the Piedmont Uplands section, which is essentially a deeply incised plateau in which valley slopes predominate.

More than 95 percent of the area drains to the Susquehanna River; the remaining area drains to the Potomac River (Plate 2). Both the drainage pattern and the drainage density differ from place to place, reflecting the control exerted by the geology. For example, trending northeastward through the middle of the area is a zone in which the streams exhibit a prominent rectangular to semirectangular drainage pattern with major stream directions toward the northwest and northeast. This zone is underlain mainly by the Marburg Schist, and the drainage is controlled by the steeply dipping, northeastward-trending schistosity and the prominent northwestward-trending jointing in this unit.

Control of the drainage pattern by schistosity and jointing is least apparent north and south of the Marburg Schist. The drainage pattern south of the Marburg Schist is largely dendritic. This area is underlain mainly by the albite-chlorite schist of the Wissahickon Formation; the dip of the schistosity is more gentle and the depth of weathering is deeper than in the Marburg. The drainage pattern north of the Marburg Schist, like the rock types and the geologic structure, is more diverse than in any other part of the area. Here the drainage patterns range from semiradial around the Pigeon Hills and Hellam Hills, which are underlain by quartzose metamorphic rocks, to semirectangular in Kreutz Creek valley, which is underlain by shaly limestone of the Conestoga Formation.

In places underlain by carbonate rocks, the drainage density is noticeably lower than it is throughout the rest of the area. The carbonate rocks are soluble and develop large underground channels (conduits) that generally route larger proportions of drainage water through the groundwater reservoir and, therefore, have fewer surface streams than do the other rocks.

CLIMATE

The climate of York County is humid and characterized by warm summers and mild winters. Data from the meteorological station at York, Pennsylvania (U. S. Department of Commerce, 1970), for 1931-71 show that the average annual temperature was 53.6°F (12°C), and that the average annual precipitation was 40.79 inches (103.6 cm). Snowfall averaged about 30 inches (76 cm) per year. The length of the growing season ranged widely from year to year but averaged about 160 days—from May 1 to October 8.

Average monthly temperatures and average monthly precipitation totals are presented in Table 1.

Table 1. *Average Monthly Temperatures and Average Monthly Precipitation for the Period 1931-71 at York, Pennsylvania*[1]

Month	*Temperature (°F)*	*Precipitation (inches)*
January	32.1	2.82
February	32.9	2.43
March	41.4	3.54
April	52.3	3.51
May	62.9	3.82
June	71.4	3.65
July	75.4	4.04
August	73.6	4.38
September	66.9	3.23
October	55.6	3.17
November	44.4	3.23
December	33.7	2.97

[1] U. S. Department of Commerce (1970).

POPULATION AND WATER USE

The 1970 population of the study area in York County was approximately 203,000, according to census statistics compiled by the York County Planning Commission. Most of this population resides in the York-Hanover valley.

Total water use in the York County part of the study area for 1970 was estimated to be 10.7 billion gallons (40,500,000 kl). This figure was compiled from records of public water use supplied by municipalities and private water companies to the Pennsylvania Department of Health; from records of industrial and commercial water use supplied by companies to the Pennsylvania Department of Internal Affairs, Bureau of Statistics; and from the authors' estimate of rural usage, assuming 100 gpd (gallons per day) (380 l/d) per person including farm and stock use.

The average per capita use of water in 1970 throughout the York County part of the area was 140 gpd (530 l/d). This amount was weighted heavily by the data from the York Water Company, which supplied about 60 percent of the area's population with about 70 percent of the water used. The 1970 water use for the York Water Company's service area (7.3 billion gallons) (27,600,000 kl) represents a 30 percent increase over the 1960 water use (5.5 billion gallons (20,800,000 kl), Bourquard, Geil, and Associates, 1962). This use is the largest in any of

the municipal and public water supply service areas and reflects the heavily commercialized-industrialized nature of the company's service area. Table 2 shows the relationship between population and water use in 1970 for selected communities in the study area.

Table 2. *Relationship Between Population and Water Use in 1970 for Selected Communities in Central and Southern York County*

Community	*1970 per capita water use (in gallons per day)*	*1970 population served (in thousands)*
Delta	113	0.80
East Prospect	35	.60
Glen Rock	72	1.60
Hanover	103	27.5
Loganville	76	.90
Nashville	70	.23
New Freedom	150	1.45
Railroad	79	.32
Red Lion, Dallastown, and Yoe	123	9.90
Shrewsbury	46	2.50
Seven Valleys	63	.68
Spring Grove	119	1.60
Stewartstown	50	1.20
Windsor	75	1.25
Wrightsville	98	2.6
York	170	117.6
York New Salem	79	1.1

Of the total water used during 1970 in the York County study area, 8.9 billion gallons (33,700,000 kl) (83 percent) was drawn from streams (surface water) and 1.8 billion gallons (6,800,000 kl) (17 percent) was drawn from wells or springs (ground water). Ground water, therefore, appears to constitute a rather small part of the water resources that are utilized. However, because approximately 65 percent of the surface water has been routed through the subsurface as ground water, rather than moving directly to the streams by overland flow, approximately 70 percent of the total water used was ground water (see section entitled "Ground-Water Contribution to Streamflow").

GEOLOGY

RELATION OF GEOLOGY TO GROUND WATER

An understanding of the geology of the area is essential to the evaluation of the ground-water resources because the rocks and weathered rock material comprise a complex natural system for storing and transmitting ground water.

The ground-water reservoir in York County consists essentially of a regolith of variable thickness and the underlying bedrock. In the regolith, ground water occurs in pores or intergranular openings (called primary openings). The character and thickness of the regolith is important because the water stored here also acts as a source of recharge to the underlying fractured bedrock. In the bedrock, ground water occurs principally along bedding, cleavage, and schistosity planes, and along fractures such as faults and joints (called secondary openings). The distribution and intensity of fracture development is a function of the lithology and structural history of the bedrock.

The chemical characteristics of the rocks have a direct bearing on the quality of the ground water. Precipitation dissolves constituents from the regolith and bedrock as it infiltrates to the water table, and thereafter, as it moves through the rocks in the saturated zone.

GENERAL GEOLOGY

The geology of the area is extremely complex and has been the subject of much study and controversy. The following discussion is based on Stose and Stose (1944) and Stose and Jonas (1939). A generalized geologic section is given in Table 3, a geologic map is shown in Plate 1, and the major geologic structures are shown in Figure 2.

The major structural feature is the Martic overthrust block, a huge block of rock that includes the southern three fifths of the area. This block is believed to have been thrust or pushed into its present position from the southeast by mountain-building forces. Minor structural features include the Tucquan anticline and the Peach Bottom, Wentz, and Yoe synclines on the Martic overthrust block; and the Pigeon Hills and Hellam Hills anticlinoria, Stoner overthrust, and the Wrightsville syncline north of the Martic overthrust. Within and between these named features the rocks are complexly folded and broken by minor faults.

The Martic overthrust block consists of rocks of probable Paleozoic and Precambrian age. The rocks in this block, from northwest to southeast, are the Wissahickon Formation (mainly composed of albite-chlorite schist and infolded metabasalt), Peters Creek Schist, Cardiff Conglomerate, and Peach Bottom Slate. The Wissahickon Formation includes the Marburg Schist and two small areas of infolded Wakefield Marble. The Marburg Schist occupies the northern part of the thrust block and overlies unconformably the adjacent rocks to the north.

Paleozoic rocks underlie most of the area north of the Martic overthrust block. Carbonate rocks occur in the York-Hanover valley. Quartzites with interbedded phyllites and slates occur in the low hills south of

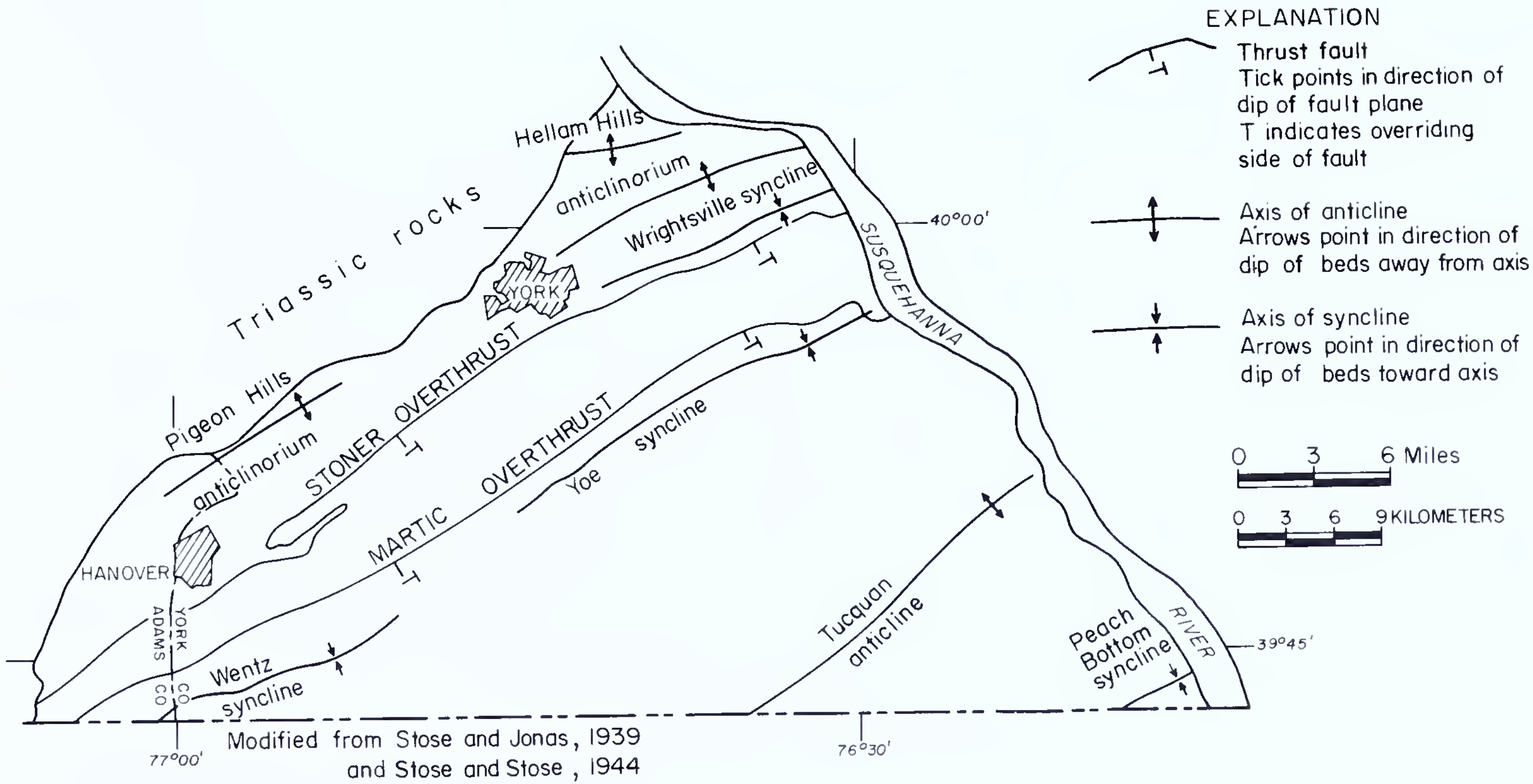


Figure 2. Sketch map showing the major geologic structures in the study area.

Table 3. *Generalized Geologic Section*[1]

System	Series	Formation	Thickness (in feet)	Character
North of Martic overthrust				
Triassic		Diabase	(?)	Fine- to medium-grained dark-gray to black rock whose chief constituents are laths of grayish-green plagioclase, andesine, or labradorite, and interstitial green augite. Present in dikes.
Ordovician	Lower Ordovician	Conestoga Formation	300–1,000	Limestone, argillaceous in places, thin- and thick-bedded with thin partings of graphitic shale.
Cambrian	Lower Cambrian	Ledger Formation	1,200±	Massive granular gray dolomite; chert horizon occurs near top of formation.
		Kinzers Formation	160– 400	Upper member—earthy limestone containing dark argillaceous layers; middle memher—limestone of variable composition; lower member—dark shale with earthy limestone.
		Vintage Formation	500– 800	Upper part of formation is primarily pure fine-grained limestone, finely banded or mottled by wavy dark layers. Lower part of formation is chiefly a blue knotty dolomite.
		Antietam Formation	100– 200	Fine- to medium-grained phyllitic quartzite.
		Harpers Formation	800–1,000	Dark-gray quartzose phyllite; contains beds of dense green ferruginous quartzite and magnetite-bearing gray quartzite.
		Chickies Formation	400– 900	Massive, prominently bedded, white vitreous quartzite north of the Stoner overthrust. Black shiny slate with numerous thin plates and thicker zones of quartzite south of the Stoner overthrust. A basal conglomerate member made up of quartzose conglomerate, feldspathic quartzite, and interbedded black slate is present north and south of the Stoner overthrust.
Precambrian		Metabasalt	(?)	Grayish-green to bluish-gray hornblende schist, blotched with green epidote.
		Volcanic slate	(?)	Blue and dark-purple sparkling sericite slate, in part amygdaloidal and containing dust-like particles of hematite.
		Metarhyolite	(?)	Fine-grained hard dense metarhyolite with or without phenocrysts of feldspar and quartz.

South of Martic overthrust				
Triassic		Diabase	(?)	Fine- to medium-grained dark-gray to black rock whose chief constituents are laths of grayish-green plagioclase, andesine or labradorite, and interstitial green augite. Present as dikes.
		Peach Bottom Slate	(?)	Blue-black slate; finely lustrous on cleavage surfaces.
		Cardiff conglomerate	(?)	Greenish-gray quartz conglomerate with muscovite partings.
		Serpentinite	(?)	Dark-green serpentine mottled with light green; the body is broken up, slickensided, and contains magnetite.
		Peters Creek Schist	(?)	Series of light-greenish-gray muscovite, chlorite, and quartz schists interbedded with quartzite.
Probably Lower Paleozoic	Glenarm	Wissahickon Formation		
		Albite chlorite schist	(?)	Coarse- to medium-grained, sparkling, grayish-blue or green schist whose dominant minerals are albite, chlorite, muscovite, and quartz; interlayered with quartzite and muscovite and chloritoid schist.
		Marburg Schist	(?)	Bluish-gray to silvery-green fine-grained schist, containing muscovite, chlorite, albite or chloritoid, and quartz; quartzites interbedded with slate and schist are closely infolded in synclines in Marburg Schist.
		Wakefield Marble	(?)	Blue thin-bedded crystalline limestone with argillaceous bands and greenish medium-grained calcareous schist.
		Metavolcanics	(?)	Green schistose rocks composed of albite, uralite, hornblende, and epidote, locally amygdaloidal; veins of quartz and epidote.

[1] Adapted from Stose and Jonas (1939); Stose and Stose (1944); and Gray and others (1960).

the valley, and on the flanks of the Hellam Hills and Pigeon Hills. Precambrian volcanic rocks are exposed in the cores of the anticlinal Hellam Hills and Pigeon Hills. From youngest to oldest, the rocks north of the Martic overthrust block are the Conestoga, Ledger, Kinzers, and Vintage Formations (chiefly carbonates), and the Antietam, Harpers, and Chickies Formations, metabasalt, and metarhyolite (noncarbonates). During Triassic time diabase dikes were intruded along zones of weakness throughout the area.

SUMMARY OF WATER-BEARING AND WATER-QUALITY CHARACTERISTICS OF THE BEDROCK AQUIFERS

The important hydrologic and water-quality characteristics of the major bedrock aquifers in the study area are discussed in the following pages and summarized on Plate 1. The rocks are divided into a carbonate group and a noncarbonate group and discussed in alphabetical order within each group. The diabase, metabasalt in the northern part of the area, volcanic slate, metarhyolite, Cardiff Conglomerate, serpentinite, and actinolite schist are not included in the following discussions because these rocks collectively make up a small part of the study area, and data are insufficient to permit their evaluation.

The information relating to the depth of water-bearing zones was extracted from Table 7; the 1-hour specific-capacity information was taken from Table 6; the extrapolation of specific capacity from 1 to 24 hours of pumping was based on Figure 5 and text related to that figure. The phrase "one of every four wells," and the related yield, drawdown, and pumping time specifications were derived from the 25 percentile column shown in Table 10 and text related to that table. The water-quality information was extracted from Tables 13, 14, 15, and 18. The depth of the wells was derived from Table 17 and the text related to that table.

CARBONATE ROCKS

Conestoga Formation

The Conestoga Formation is the most extensive carbonate rock aquifer in the study area; it constitutes about 7 percent of the total area. Most of the water-bearing zones are fairly shallow; very few have been reported below 200 feet (60 m) below land surface. The 1-hour specific capacities of 32 wells ranged from 0.04 to 45 gpm/ft (0.008 to 9.3 (l/s)/m), and the median was 1.3 gpm/ft (0.27 (l/s)/m). From these data it is estimated that the average well drilled 200 feet (60 m) deep would yield about 65

gpm (4.1 l/s) with 50 feet (15 m) of drawdown after pumping for 1 hour. Aquifer tests made for extended periods on wells in this formation (wells Yo-95, 96, 241, 278, 282, 546, 631, and 694) indicate that the shallow water-bearing zones are dewatered by continuous pumping and the initial well yield is substantially decreased. The yield of the average well would probably be reduced from 65 gpm (4.1 l/s) to about 20 gpm (1.3 l/s) after 24 hours of pumping. One of every four wells drilled 200 feet (60 m) deep would yield about 140 gpm (8.8 l/s) with 50 feet (15 m) of drawdown after 24 hours of pumping. The maximum reported well yield for this formation in the study area is 250 gpm (16 l/s).

The field pH of 19 water samples from wells in this formation ranges from 6.8 to 8.0 and the median is 7.0. The hardness of 32 samples ranges from 6 to 23 gpg (100 to 390 mg/l) and the median is 13 gpg (220 mg/l). Specific conductance of 40 samples ranges from 250 to 940 micromhos and the median is 550.

The ranges and median concentrations, in milligrams per liter, of total iron, total manganese, and nitrate determined from eight standard complete chemical analyses are 0.00 to 1.6 and 0.16; 0.00 to 0.08 and 0.01; and 8 to 58 and 33, respectively. The median nitrate concentration is the highest of all the aquifers studied. The water is a calcium bicarbonate type.

Limestones of the Kinzers Formation

The carbonate rocks of the Kinzers Formation comprise about 3 percent of the study area, and the areas underlain by these rocks are small or discontinuous. The purer limestone units are quarried or mined extensively, and many water-bearing zones in the vicinity of these operations have been dewatered by mine and quarry pumping. This pumping is reflected in the fact that the median water level in 23 wells was 40 feet (12 m) below land surface, the deepest of any aquifer except the Peach Bottom Slate. The 1-hour specific capacities of 10 wells ranged from 0.028 to 92 gpm/ft (0.0058 to 19 (l/s)/m), and the median was 0.06 gpm/ft (0.01 (l/s)/m), the lowest of all the aquifers studied. From these data it is estimated that the average well drilled 200 feet (60 m) deep would yield about 2 gpm (0.13 l/s) with 50 feet (15 m) of drawdown after 24 hours of pumping. One of every 4 wells drilled 200 feet (60 m) deep would yield between 10 and 15 gpm (0.63 and 0.95 l/s) with 50 feet (15 m) of drawdown after pumping for 1 day. The maximum well yield reported for these rocks in the study area is 100 gpm (6.3 l/s).

Field data show that the pH of 17 samples ranges from 6.5 to 7.5, hardness of 21 samples ranges from 8 to 20 gpg (140 to 340 mg/l), and the specific conductance of 21 samples ranges from 325 to 1,150 micromhos.

The medians are: pH, 7.2; hardness, 12 gpg (200 mg/l); and specific conductance, 525 micromhos.

The median concentrations of total iron, total manganese, and nitrate determined from four chemical analyses are 0.35, 0.005, and 17 mg/l, respectively. Total iron concentration ranges from 0.03 to 0.04 mg/l. Total manganese has a range from 0.00 to 0.01 mg/l. Nitrate concentration ranges from 14 to 154 mg/l. The water is a calcium bicarbonate type.

Ledger Formation

The Ledger Formation has the smallest areal extent of all the major carbonate aquifers. It underlies about 2 percent of the entire study area. The largest uninterrupted area underlain by this formation is west of the city of York, between Pigeon Hills and Hellam Hills. Pumping from quarries affects the water level in this aquifer locally. Meager data on water-bearing zones suggest that this formation is the only one in which the frequency of occurrence of permeable zones increases consistently up to depths of about 150 to 200 feet (45 to 60 m) below land surface.

Specific-capacity data indicate that this formation is by far the most productive aquifer in the entire study area. The 1-hour specific capacities of 10 wells ranged from 0.05 to 18 gpm/ft (0.01 to 3.7 (l/s)/m) and the median was 6.4 gpm/ft (1.3 (l/s)/m). From these data it was estimated that an average well drilled about 250 feet (75 m) deep would have a yield of about 300 gpm (19 l/s) with 50 feet (15 m) of drawdown after pumping for 1 hour. Aquifer tests made for extended periods on wells in these rocks (wells Yo-242, 361, 547, 649, 726, and 727) indicate that continuous pumping for 24 hours would reduce the yield of the average well by about one third, from 300 to 200 gpm (19 to 13 l/s). One of every four wells drilled 250 feet (75 m) deep would produce about 400 gpm (25 l/s) with 50 feet (15 m) of drawdown after 24 hours of pumping. The maximum reported well yield for the Ledger Formation in the study area is 800 gpm (50 l/s).

The field pH of 10 water samples ranges from 7.0 to 8.0, and the median is 7.2. Hardness of 11 samples ranges from 7 to 19 gpg (120 to 320 mg/l) and the median is 16 gpg (270 mg/l). Specific conductance of 10 samples ranges from 260 to 1,500 micromhos and the median is 625 micromhos. The median hardness and specific conductance are the highest of all the aquifers studied.

Three samples were analyzed in the laboratory. Total iron concentration ranges from 0.15 to 0.7 mg/l and the median concentration is 0.5 mg/l. Total manganese ranges from 0 to 15 mg/l and the median con-

centration is 0.01 mg/l. Nitrate concentration ranges from 0.9 to 35 mg/l and the median is 5.4 mg/l. The water is a calcium bicarbonate type.

Vintage Formation

The rocks of the Vintage Formation comprise about 3 percent of the area. The areas underlain by this formation are discontinuous and rather small. Many shallow water-bearing zones in these rocks have been dewatered by pumping from quarries or mines in this formation and in the purer limestone units of the Kinzers Formation. Data on depth to water-bearing zones indicate that most zones occur between land surface and about 200 feet (60 m) below land surface. One-hour specific capacities of nine wells tested during the investigation ranged from 0.035 to 18 gpm/ft (0.0072 to 3.7 (l/s)/m) and the median was 0.16 gpm/ft (0.033 (l/s)/m). The average well drilled 200 feet (60 m) deep would yield about 4 gpm (0.25 l/s) with 50 feet (15 m) of drawdown after pumping for 1 day. Further, one out of four wells drilled 200 feet (60 m) deep would produce about 40 gpm (2.5 l/s) with 50 feet (15 m) of drawdown after pumping for 1 day. The maximum well yield reported for the Vintage Formation in the study area is 300 gpm (19 l/s).

The median field pH of 14 water samples is 7.2 and the range is from 6.0 to 8.0. The median hardness of 15 samples is 11 gpg (190 mg/l) and the range is from 4 to 17 gpg (70 to 290 l/s). The median specific conductance is 410 micromhos and the range is from 295 to 750 micromhos.

Three samples were analyzed in the laboratory. Total iron ranges from 0.03 to 0.73 mg/l and the median concentration is 0.15 mg/l. Total manganese ranges from 0.00 to 0.09 mg/l and the median concentration is 0.01 mg/l. The median nitrate concentration is 17 mg/l and the range is from 9 to 25 mg/l. The water is a calcium bicarbonate type.

Wakefield Marble

The Wakefield Marble constitutes less than half of one percent of the entire study area and is not an important aquifer in York or Adams County. Only one well was inventoried in these rocks. It was 125 feet (38 m) deep and had a specific capacity of 2.6 gpm/ft (0.54 (l/s)/m) after pumping for 1 hour at a rate of about 4 gpm (0.25 l/s).

The field pH, hardness, and specific conductance of water from this well are 7.0, 7 gpg (120 mg/l), and 350 micromhos, respectively. Total iron, total manganese, and nitrate are 0.15, 0.02, and 47 mg/l, respectively. The water is a calcium bicarbonate type.

NONCARBONATE ROCKS

Antietam Formation

The Antietam Formation comprises about 4 percent of the study area and is found exclusively in the Conestoga Valley section (Figure 1). The largest area underlain by this aquifer is about 3 miles (5 km) south of Wrightsville and extends southwestward, in a narrowing band, to a point about 3 miles (5 km) south of York. The other areas underlain by this formation are small or discontinuous. Reported data on water-bearing zones indicate that few zones occur more than 150 feet (45 m) below land surface. One-hour specific capacities of 11 wells range from 0.037 to 5.3 gpm/ft (0.0077 to 1.1 (l/s)/m); the median is 0.12 gpm/ft (0.025 (l/s)/m), the lowest of all the noncarbonate rocks studied. The estimated potential yield of the average well drilled 150 feet (45 m) deep is about 3 gpm (0.19 l/s) with 50 feet (15 m) of drawdown after 24 hours of pumping. One of every four wells drilled 150 feet (45 m) deep would yield between 10 and 15 gpm (0.63 and 0.95 l/s) with 50 feet (15 m) of drawdown after pumping for 24 hours. The maximum well yield reported in the study area is 40 gpm (2.5 l/s).

An analysis of field data indicates that the pH of 15 water samples from this aquifer ranges from 5.5 to 6.5 and the median is 6.0. The hardness of 17 samples ranges from 1 to 8 gpg (17 to 140 mg/l) and the median is 3 gpg (50 mg/l). Specific conductance of 18 samples ranges from 60 to 430 micromhos and the median is 185 micromhos.

Five samples were analyzed in the laboratory. Total iron ranges from 0.01 to 0.55 mg/l and the median concentration is 0.02 mg/l. Total manganese ranges from 0.00 to 0.07 mg/l and the median concentration is 0.03 mg/l. Nitrate ranges from 3 to 26 mg/l and the median concentration is 18 mg/l. The water is a calcium bicarbonate type.

Chickies Formation

The rocks of the Chickies Formation constitute about 8 percent of the entire study area and are primarily concentrated in the Hellam Hills and Pigeon Hills and in northeast-trending bands south of York and Hanover. Water-bearing zones are reported to occur with consistent frequency to about 200 feet (60 m) below land surface. The 1-hour specific capacities of 21 wells tested during the investigation range from 0.04 to 780 gpm/ft (0.008 to 160 (l/s)/m) and the median is 0.34 gpm/ft (0.070 (l/s)/m). The average well drilled 200 to 250 feet (60 to 75 m) deep would yield about 8 gpm (0.50 l/s) with 50 feet (15 m) of drawdown after pumping for 1 day. The yield of the average well would be between 15 and 20 gpm (0.95 and 1.3 l/s) with 50 feet (15 m) of drawdown after pumping for

1 hour. One of every four wells drilled 200 to 250 feet (60 to 75 m) deep would produce about 55 gpm (3.5 l/s) with 50 feet (15 m) of drawdown after 24 hours of pumping. The maximum reported well yield for the Chickies Formation in the study area is 100 gpm (6.3 l/s).

The field pH of 20 water samples from these rocks ranges from 5.0 to 6.5 and the median is 5.5. These data indicate that the water from these rocks is more acidic than that from any other aquifer studied. Hardness of 29 samples ranges from 1 to 6 gpg (17 to 100 mg/l) and the median is 2 gpg (34 mg/l). Specific conductance of 29 samples ranges from 10 to 420 micromhos and the median is 80 micromhos.

Samples from eight wells were analyzed in the laboratory. Total iron ranges from 0.10 to 2.5 mg/l and the median concentration is 0.27 mg/l. Total manganese ranges from 0.01 to 0.60 mg/l and the median concentration is 0.04 mg/l. No nitrate was found in three samples. Where present, nitrate ranged from 3 to 14 mg/l. The median nitrate concentration of the eight samples was 4.9 mg/l. The median nitrate concentration is the lowest of all the aquifers. The water is a calcium magnesium sulfate bicarbonate type.

Harpers Formation

The Harpers Formation comprises a little over 10 percent of the area. This aquifer is mainly confined to a long northeastward-trending band north of the Martic overthrust. There are smaller, discontinuous areas underlain by this formation in and around the Hellam Hills and Pigeon Hills. Water-bearing zones are reported to occur as deep as 250 or 300 feet (75 or 90 m) below land surface. One-hour specific capacities from 27 wells range from 0.03 to 3 gpm/ft (0.006 to 0.6 (l/s)/m) and the median is 0.39 gpm/ft (0.08 (l/s)/m). The short-term (1-hour) yield of the average well drilled between 250 and 300 feet (75 and 90 m) deep is estimated to be about 20 gpm (1.3 l/s) with 50 feet (15 m) of drawdown. Aquifer tests made for extended periods on wells in this formation (wells Yo-728, 764, 766, 808, 813, and 814) indicate that the yield of the average well would be about 10 gpm (0.63 l/s) after pumping for 24 hours. About one quarter of the wells drilled about 300 feet (90 m) deep would yield between 15 and 20 gpm (0.95 and 1.3 l/s) with at least 50 feet (15 m) of drawdown after pumping for 24 hours. The maximum reported well yield for these rocks in the study area is 100 gpm (6.3 l/s).

The field pH of 31 ground-water samples from the Harpers Formation ranges from 5.3 to 7.5 and the median is 6.0. The hardness of 54 samples ranges from 1 to 15 gpg (17 to 260 mg/l) and the median is 5 gpg (85 mg/l). Specific conductance of 57 samples ranges from 35 to 600 micromhos and the median is 220 micromhos.

Samples from eight wells were analyzed in the laboratory. Total iron ranges from 0.01 to 1.2 mg/l and the median concentration is 0.07 mg/l. Total manganese ranges from 0.00 to 0.29 mg/l and the median concentration is 0.05 mg/l. Nitrate ranges from 0 to 88 mg/l and the median concentration is 11 mg/l. The water is a calcium magnesium chloride bicarbonate type.

Shale of the Kinzers Formation

The shale of the Kinzers Formation constitutes slightly more than 1 percent of the entire study area. These rocks are exposed in narrow and discontinuous bands and are sandwiched between the limestones of the Kinzers Formation and the dolomite of the Vintage Formation. Reported water-bearing-zone data indicate that most zones occur between land surface and about 200 feet (60 m) below land surface. The 1-hour specific capacities of six wells range from 0.06 to 5.3 gpm/ft (0.01 to 1.1 (l/s)/m) and the median is 0.35 gpm/ft (0.072 (l/s)/m). The average well drilled 200 feet (60 m) deep would yield about 10 gpm (0.63 l/s) with 50 feet (15 m) of drawdown after pumping for 24 hours. In addition, one of every four wells drilled 200 feet (60 m) deep would produce about 65 gpm (4 l/s) with 50 feet (15 m) of drawdown after pumping for 1 day. The maximum reported well yield for these rocks in the study area is 111 gpm (7 l/s).

The water from this shale has chemical qualities that are intermediate between the carbonates and the other noncarbonate rocks, probably because this shale is between carbonates and is calcareous in nature. The field pH of four samples ranges from 5.5 to 6.9 and the median is 6.6. The hardness of 8 samples ranges from 3 to 12 gpg (50 to 200 mg/l) and the median is 7 gpg (120 mg/l). The specific conductance of 7 samples ranges from 120 to 420 micromhos and the median is 330 micromhos.

One sample of ground water was analyzed in the laboratory. Total iron, total manganese, and nitrate concentrations were 0.40, 0.01, and 16 mg/l, respectively. The water is a calcium bicarbonate type.

Marburg Schist

The Marburg Schist is confined to a wide and centrally located, northeastward-trending band that occupies about 17 percent of the study area. Most water-bearing zones are reported to occur between land surface and about 200 feet (60 m) below land surface. One-hour specific capacities from 37 wells range from 0.035 to 2.15 gpm/ft (0.0072 to 0.45 (l/s)/m) and the median is about 0.28 gpm/ft (0.058 (l/s)/m). The short-term (1-hour) yield of the average well drilled 200 feet (60 m) deep would be about 15 gpm (0.95 l/s) with 50 feet (15 m) of drawdown. Aquifer tests made for extended periods on wells in this formation (wells Yo-322, 759,

768, 809, and 811) indicate that the yield of the average well (15 gpm, or 0.95 l/s) will probably be about 5 gpm (0.32 l/s) after pumping for 24 hours. One of every four wells drilled 200 feet (60 m) deep would produce about 15 gpm (0.95 l/s) with 50 feet (15 m) of drawdown after 24 hours of pumping. The maximum reported well yield for the Marburg Schist in the study area is 70 gpm (4.4 l/s).

The field pH of 45 water samples from this aquifer ranges from 5.0 to 7.8 and the median is 6.0. The hardness of 71 samples ranges from 1 to 11 gpg (17 to 190 mg/l) and the median is 3 gpg (50 mg/l). The specific conductance of 72 samples ranges from 20 to 430 micromhos and the median is 130 micromhos.

Total iron concentrations, as determined from nine samples, range from 0.05 to 8.4 mg/l and the median concentration is 0.17 mg/l. Total manganese concentrations range from 0.01 to 0.18 mg/l and the median concentration is 0.03 mg/l. Ten nitrate analyses range from 0.1 to 51 mg/l and the median is 13 mg/l. The water is a calcium bicarbonate nitrate type.

Peach Bottom Slate

The Peach Bottom Slate occupies a narrow band that extends across the southeastern corner of the study area. It occupies less than half of one percent of the entire area but serves as the principal aquifer for the municipal supply wells at Delta, Pennsylvania. Only three 1-hour specific-capacity tests were made on wells in this aquifer; the values are 0.52, 1.4, and 6.8 gpm/ft (0.11, 0.29, and 1.4 (l/s)/m). The two higher values were obtained from two of the municipal supply wells at Delta. These wells are 110 and 212 feet (34 and 65 m) deep and are pumped at an average rate of about 25 gpm (1.6 l/s) year after year.

The field pH of four water samples from this aquifer ranges from 5.3 to 6.2 and the median is 6.2. The hardness of these samples ranges from 1 to 3 gpg (17 to 50 mg/l) and the median is 1.5 gpg (25 mg/l). The specific conductance of 6 samples ranges from 50 to 130 micromhos and the median is 70 micromhos.

Two samples were collected for standard complete chemical analysis. Total iron, total manganese, and nitrate range from 0.11 to 0.70 mg/l, 0.00 to 0.09 mg/l, and 8 to 34 mg/l, respectively. The water is a calcium sodium nitrate bicarbonate type.

Peters Creek Schist

The Peters Creek Schist comprises about 3 percent of the study area and is in the southeastern corner of York County. Water-bearing-zone data were not available for this aquifer. One-hour specific capacities for seven

wells range from 0.07 to 3.3 gpm/ft (0.01 to 0.68 (l/s)/m) and the median is 0.70 gpm/ft (0.14 (l/s)/m). The average well drilled 250 to 300 feet (75 to 90 m) deep would yield about 20 gpm (1.3 l/s) with at least 50 feet (15 m) of drawdown after 24 hours of pumping. The short-term yield (1-hour) for the average well would be about 35 gpm (2.2 l/s). Further, one of every four wells drilled 250 to 300 feet (75 to 90 m) deep would yield about 70 gpm (4.4 l/s) with at least 50 feet (15 m) of drawdown after pumping for 1 day. The maximum reported well yield for the Peters Creek Schist in the study area is 60 gpm (3.8 l/s).

The field pH of 10 water samples from these rocks ranges from 5.2 to 6.8 and the median is 5.7. Hardness ranges from 1 to 6 gpg (17 to 100 mg/l) for 13 samples and the median is 2 gpg (34 mg/l). Specific conductance of 12 samples ranges from 50 to 265 micromhos and the median is 117 micromhos.

In three of four samples, total iron concentrations exceed 1.0 mg/l (1.1, 2.9, and 3.4 mg/l). The median concentration is 2.0 mg/l. Total manganese concentrations in these four samples range from 0.02 to 0.09 mg/l and the median concentration is 0.03 mg/l. Nitrate concentrations of five samples range from 6 to 55 mg/l and the median concentration is 22 mg/l. The water is a calcium magnesium nitrate bicarbonate type.

Wissahickon Formation

The Wissahickon Formation is the most widespread aquifer studied; it constitutes about 40 percent of the entire area (Plate 1). Water-bearing zones are reported to occur consistently between land surface and about 400 feet (120 m) below land surface. Specific-capacity data indicate that the Wissahickon is one of the most productive aquifers studied during this investigation. The 1-hour specific capacities of 72 wells range from 0.03 to 50 gpm/ft (0.006 to 10 (l/s)/m) and the median is 0.95 gpm/ft (0.20 (l/s)/m). The average well drilled 400 feet (120 m) deep would yield about 45 gpm (2.8 l/s) with 50 feet (15 m) of drawdown after pumping for 1 hour. Aquifer tests made for extended periods on wells (Yo-231, 232, 233, 266, 518, and 602) indicate that the yield of the average well (45 gpm, or 2.8 l/s) would probably be about 30 gpm (1.9 l/s) after pumping for 24 hours. In addition, one of every four wells drilled 400 feet (120 m) deep would produce about 80 gpm (5.0 l/s) with 50 feet (15 m) of drawdown after pumping for 1 day. The maximum reported well yield for this formation in the study area is 150 gpm (9.5 l/s).

The field pH of 48 water samples from this aquifer ranges from 5.0 to 7.0 and the median is 5.9. Hardness of 92 samples ranges from 1.0 to

10 gpg (17 to 170 mg/l) and the median is 2 gpg (34 mg/l). Specific conductance of 115 samples ranges from 25 to 560 micromhos and the median is 125 micromhos.

Thirty-four water samples were analyzed in the laboratory. The median concentration of total iron is 0.08 mg/l and the range in concentration is 0.01 to 1.6 mg/l. Total manganese ranges from 0.00 to 0.95 mg/l and the median concentration is 0.02 mg/l. Nitrate concentrations range from 2 to 94 mg/l and the median is 28 mg/l. The median nitrate concentration is the highest of the noncarbonate rocks. The water is a calcium magnesium nitrate bicarbonate type.

HYDROLOGY AND WATER QUALITY

HYDROLOGIC CYCLE

Water on the earth is kept in never-ending circulation between the oceans, the atmosphere, and the land by energy supplied from the sun. This circulation process is known as the hydrologic cycle. Water is evaporated mainly from the oceans and seas and held in the atmosphere until it is released as precipitation. Some precipitation is returned to the atmosphere by evaporation, some is transpired by plants, some flows overland to streams, and some infiltrates the soil, percolates downward to the water table, and becomes ground water. The ground water moves slowly through interconnected voids in the rock to points of discharge such as springs and wells. Most of the water that is added to and moves through the ground-water reservoir is eventually discharged into streams. (Streamflow is sustained entirely by ground-water discharge except during periods of precipitation and subsequent overland runoff.) Streams carry the water to the oceans and seas and the cycle continues.

A knowledge of the amount of water distributed to each part of the hydrologic cycle and how the amounts change with time is essential to the proper evaluation, development, and management of the ground-water resources of any area. Such information was obtained for the study area by preparing water budgets for selected drainage basins in central and southern York County.

WATER BUDGETS

A water budget is a quantitative statement of the hydrologic cycle or the balance between total water gains and losses in a drainage basin for a given period of time. Any water budget can be expressed in the form of the following equation:

$$P = R + ET + \Delta SM + \Delta GW + U - I \qquad (1)$$

where

P = precipitation
R = streamflow[1]
ET = evaporation and transpiration (evapotranspiration)
ΔSM = change in soil moisture
ΔGW = change in ground-water storage
U = natural ground-water flow out of the basin
I = imported water

This equation was used to describe the water budgets on a calendar-year basis for the Muddy Creek basin (133 mi^2, or 344 km^2) above the stream gage near Castle Fin, Pennsylvania, the Codorus Creek basin (222 mi^2, or 575 km^2) above the gage 2 miles (3 km) southwest of York, the south branch of Codorus Creek (117 mi^2, or 303 km^2) above the gage below the York Water Company reservoir, and the west branch of Codorus Creek (75.5 mi^2, or 196 km^2) above the gage at Spring Grove. Figure 3 shows the location of the basins, the location of data collection sites, and the general rock types found in each of the basins. These basins occupy about 355 square miles (920 km^2), over half of the study area, and include all the significant aquifers found in the study area.

Precipitation data (P) were obtained from records of five U. S. Weather Bureau stations and one U. S. Geological Survey station. Data from each station were weighted, according to areal influence in the basins, by Thiessen net geometry (Thiessen, 1911). The weighting for each station by basin is listed in the footnotes to Table 4.

Streamflow data (R) were obtained from records of four U. S. Geological Survey stream-gaging stations. In the Codorus Creek basin streamflow data were corrected for changes in the amount of water stored in the surface-water reservoirs and for diversion or pumpage from the reservoirs for municipal and industrial water supply. No such corrections were necessary for the Muddy Creek streamflow data because there are no surface-water impoundments of significant size in the basin and there is no known diversion or pumpage from the basin. In addition, there is no imported water (I) in any of the basins.

Natural ground-water flow across the basin divides (U) was assumed to be negligible. In most places the ground-water and surface-water divides are nearly the same, and most of the rocks have low permeability so that little water is passed through the rocks beneath the stream gages.

[1] Includes corrections for change in surface-water storage and diversion where necessary.

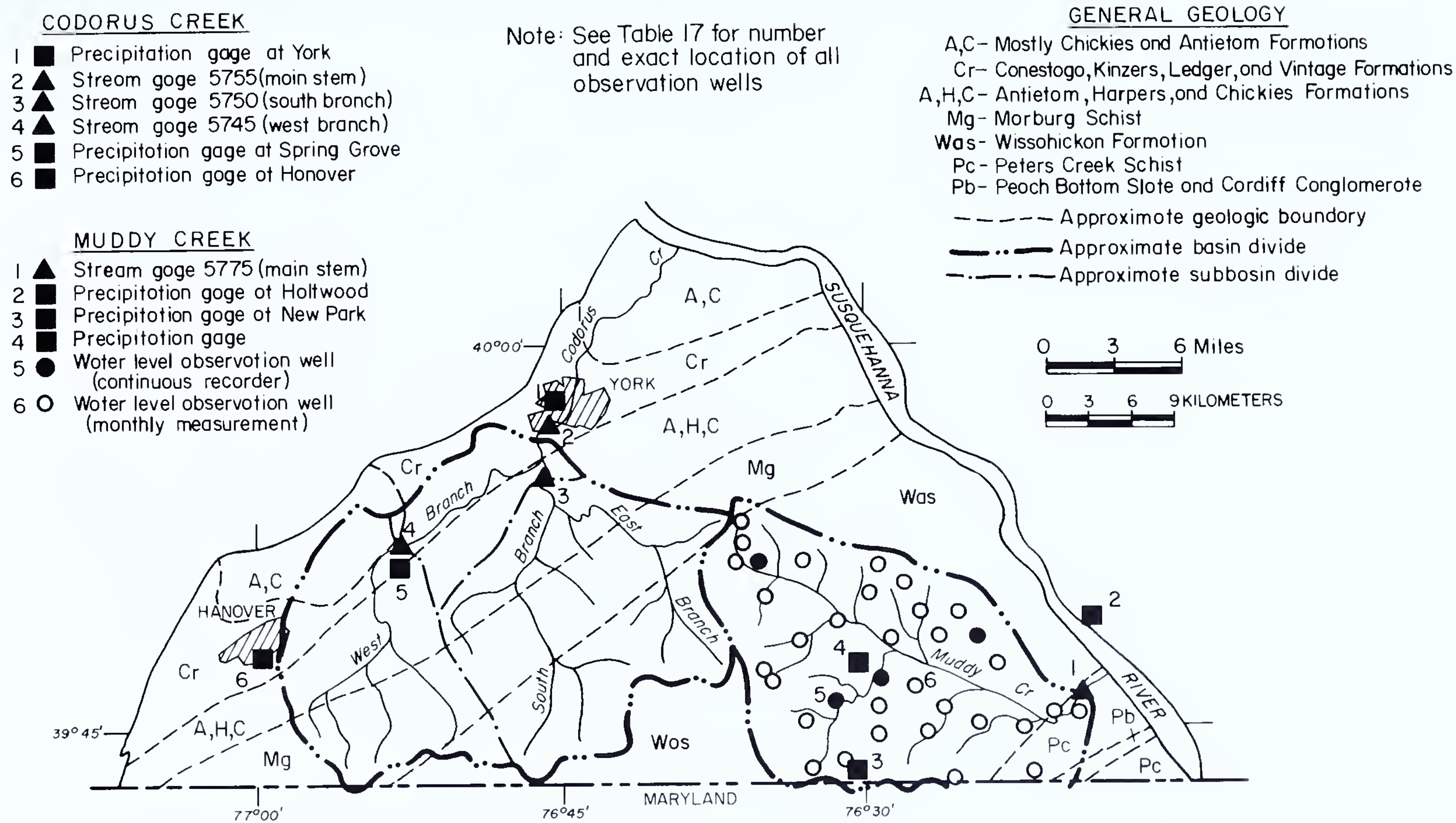


Figure 3. Map showing Codorus Creek and Muddy Creek basins, data collection stations for budget studies, and the general geology.

Table 4. *Water Budgets for Central and Southern York County*

	Basin	Area (squarc miles)	Precipitation station	Period of record	Precipitation (inches) P	=	Streamflow (inches) R	+	Evaporation and transpiration (inches) ET
LONG-TERM BUDGETS	Codorus Creek								
	West Branch	75.5	Composite[1]	1940–70	39.80	=	13.04	+	26.76
	South Branch	117	Composite[2]	1940–70	40.93	=	14.10	+	26.83
	Near York	222	Composite[3]	1940–70	41.31	=	13.69	+	27.62
				Average	40.68	=	13.61	+	27.07
	Codorus Creek								
	South Branch	117	Composite[2]	1931–39	42.00	=	14.52	+	27.48
	Muddy Creek	133	Composite[4]	1931–39	43.00	=	15.93	+	27.07
				Average	42.50	=	15.22	+	27.27

Note: the column heads Precipitation, Streamflow and Evaporation and transpiration are printed under the spanning head "Average yearly amount for period of record shown".

SHORT-TERM BUDGETS

				Precipitation (inches)	=	Streamflow (inches)	+	Water losses (inches)
				P	=	R	+	ET+GW+SM
Codorus Creek								
West Branch	75.5	Composite[1]	1963–66	32.70	=	7.97	+	24.73
South Branch	117	Composite[2]	1963–66	34.21	=	9.46	+	24.75
Near York	222	Composite[3]	1963–66	32.82	=	9.22	+	23.60
			Average	33.24	=	8.88	+	24.36
Codorus Creek								
West Branch	75.5	Composite[1]	1951–52	45.54	=	19.51	+	26.03
South Branch	117	Composite[2]	1951–52	47.01	=	21.09	+	25.92
Near York	222	Composite[3]	1951–52	46.25	=	20.19	+	26.06
			Average	46.26	=	20.26	+	26.00

[1] Hanover station (74 percent) + Spring Grove station (26 percent)
[2] Spring Grove station (39 percent) + Hanover station (23 percent) + New Park station (21 percent) + York station (17 percent)
[3] Hanover station (38 percent) + Spring Grove station (36 percent) + York station (15 percent) + New Park station (11 percent)
[4] New Park station (50 percent) + Holtwood station (50 percent) + 2.5 inches

However, the gages at Spring Grove on the west branch and near York on the main stem of the Codorus are constructed on or near carbonate rocks. Water flow through these carbonate rocks in the vicinity of these gages is possible. The data for 1940 to 1970 (Table 4) indicate that there is probably no underflow at the west-branch gage but that there may be a small amount, about 1 inch (2.5 cm), at the gage near York. Thus, estimates of evapotranspiration in the Codorus Creek basin may be slightly high when calculated with data from the gage near York.

Changes in the soil moisture (△SM) were not measured, but it is assumed the net change is generally insignificant from the beginning of one calendar year to the next. In addition, the net change in ground-water storage (△GW) is assumed to be insignificant over periods of several years.

In consideration of the above discussion and despite the inherent danger of generalizing, the terms I, U, △SM, and △GW are assumed to be negligible and equation (l) is simplified to $P = R + ET$ for the periods for which long-term water budgets were prepared. The amount of water lost to evapotranspiration (ET) in the area was estimated by computing the difference between precipitation (P) and streamflow (R) for the long-term budget periods.

Table 4 shows water budgets prepared for Muddy Creek and Codorus Creek basins for several periods and amounts of precipitation. The budgets prepared for 1940 through 1970 probably represent best the average annual conditions in the area. Under these conditions precipitation is approximately 41 inches (104 cm), streamflow is about 14 inches (36 cm), and water loss to evapotranspiration is about 27 inches (69 cm). The large evapotranspiration loss (nearly 65 percent of the average annual precipitation) is primarily due to climatic conditions in southeastern Pennsylvania. Here average annual temperatures are higher and the average annual growing, or frost-free, season is longer than in any other part of the state.

The budgets prepared for 1931 through 1939 compare conditions in the Muddy Creek and Codorus Creek basins when precipitation was an inch or two above normal.

The short-term budgets were prepared to show the general effect of wet periods (1951-52) and dry periods (1963-66) on streamflow and water losses. If the net change in soil moisture and ground-water storage within each period is small, most of the water losses were to evapotranspiration. As it is very difficult to separate the effects of evapotranspiration, changes in soil moisture, and changes in ground-water storage during short periods of record, the amounts of precipitation that are not measured as streamflow during these periods are referred to here and in Table 4 as water losses.

The averages of the short-period water budgets listed in Table 4 indicate that water losses remain fairly constant during a rather wide range of precipitation and streamflow conditions. Precipitation and streamflow averages differed by about 11 to 13 inches (28 to 33 cm) each, while the water losses differed by only 2 to 3 inches (5.1 to 7.6 cm). These data indicate that water losses ranged from 56 to 73 percent of the annual precipitation, depending upon prevailing weather conditions, while streamflow in the area ranged from 44 percent of the annual precipitation (about 20 inches, or 51 cm) from 1963 through 1966, to 27 percent (about 9 inches, or 23 cm) from 1951 through 1952.

GROUND-WATER CONTRIBUTION TO STREAMFLOW

About two thirds of the water that constitutes streamflow in the study area is estimated to come from the ground-water reservoir. This estimate was made primarily from the results of studies by the authors on the relationship between ground water and surface water in the Muddy Creek basin from January 1969 through December 1970, and from similar studies by Meisler and Becher (1971) in the Little Conestoga basin in Lancaster County from January 1964 through December 1964.

In the Muddy Creek basin, ground-water discharge was estimated by the rating curve method—by plotting mean ground-water stage in the basin against base streamflow from the basin on corresponding dates. Stream discharge was calculated (Linsley and others, 1958, p. 156) to be base streamflow, that is, to be entirely ground-water discharge about 2.5 days after the end of any precipitation.

Two rating curves were derived to estimate ground-water discharge to Muddy Creek. One curve was prepared for the data collected between November and April, a time when very little water is consumed by evapotranspiration. The other curve was prepared from the data collected between April and November, when significant quantities of water are lost through evapotranspiration from the ground-water reservoir, particularly in stream valleys where the water table is nearest to the land surface. Comparison of the total mean daily ground-water discharge estimated in this manner with the total mean daily streamflow indicates that about 70 percent of streamflow in the Muddy Creek basin was ground-water discharge. This figure is probably representative of that part of the total study area underlain by rocks similar to those in the Muddy Creek basin, or about 45 percent of the total area.

In the Little Conestoga basin in Lancaster County, Meisler and Becher (1971) estimated ground-water discharge to be approximately 77 percent of total streamflow. These results are assumed to be representative for

about 15 percent of the York-Adams County study area, where the rocks are similar to those found in the Little Conestoga basin.

Table 5 shows streamflow and other hydrologic characteristics of the Muddy Creek and Little Conestoga basins. The data indicate that about 72 percent of the streamflow comes from ground-water discharge in 60 percent of the study area. Thus, it is probable that at least 50 to 60 percent of streamflow is ground-water discharge in the remaining 40 percent of the area.

Table 5. *Hydrologic Characteristics of the Muddy Creek and Little Conestoga Creek Basins*

Basin	Little Conestoga Creek above gage at Conestoga Country Club[2]	Muddy Creek above gage near Castle Fin
County	Lancaster	York
Period of record	Jan. 1964 – Dec. 1964	Jan. 1969 – Dec. 1970
Drainage area, in mi^2	38.3	133
Average daily total discharge, in cfs	43	141
Average daily total discharge, in cfsm	1.13	1.06
Average daily ground-water discharge, in cfs	33	99
Average daily ground-water discharge, in cfsm	.86	.74
Proportion ground-water discharge of total discharge, in percent	77	70.1
Specific yield[1]	.04	.08
Percent of total study area represented	15	45

[1] Of the zone of water-table fluctuation. In Muddy Creek basin this zone is mostly regolith.

[2] From Meisler and Becher (1971)

SPECIFIC YIELD

The short-term specific yield of the material in the zone of water-table fluctuation in Muddy Creek basin (mostly regolith) was calculated by dividing the volume of water leaving the basin during base streamflow

conditions (at least 2.5 days after rain) by the volume of dewatered material throughout the basin for the same period of time (Meisler, 1963). The volume of dewatered material was determined from the basin area and the decline in the mean ground-water stage throughout the basin (as defined in the preceding section).

The average specific yield obtained in the Muddy Creek basin was 0.08 (Table 5). This value represents an average of the data obtained for three periods of 4-day duration in the nongrowing season, during which no precipitation or snowmelt occurred. Gravity drainage was not complete, and a period of longer duration would give a higher specific yield. This short-term specific yield compares favorably to the 7- to 10-percent gravity yield reported by Olmsted and Hely (1962) for similar rocks in the Brandywine Creek basin.

The average specific yield obtained by Meisler and Becher (1971, p. 56) in the Little Conestoga basin was 0.04. This value is assumed representative for the zone of water-table fluctuation in the carbonate rocks of the study area. These data plus those obtained for the Muddy Creek basin are considered to be representative of about 60 percent of the total study area (Table 5).

The specific yield of the deeper fractured bedrock is probably much lower than that of the near-surface material (Wood and others, 1972; Snow, 1968). The relatively large storage capacity in the upper part of the ground-water reservoir plays an important part in sustaining both the ground-water contribution to streamflow and the yield of wells.

TRANSMISSIVITY

The transmissivity of the rocks in the Muddy Creek basin above the gage near Castle Fin (90 percent Wissahickon Formation) was estimated from the volume of ground-water discharge, the slope of the water table, and the length of streams receiving discharge in the basin. The equation used for the estimate was adapted from Olmsted and Hely (1962) and is as follows:

$$T = \frac{Q}{I\ (2L)}$$

where

T = transmissivity, in feet squared per day

Q = ground-water discharge, in cubic feet per day (calculated from the rating curve derived from data collected during times of little or no evapotranspiration)

I = average slope of the water table, in feet per mile (calculated from the average annual water levels and the estimated length

of flow paths to discharge points from the 35 shallow observation wells throughout the basin)

L = length of stream receiving discharge, in miles (determined by the length of solid blue stream lines on U. S. Geological Survey topographic quadrangle maps, scale 1:24,000)

The following table shows the values for each parameter in the equation for the 1969 and 1970 calendar years and the averages of the 1969-70 values.

Year	*Q* (*cubic feet per day*)	*I* (*feet per mile*)	*L* (*miles*)	*T* (*feet squared per day*)
1969	5,957,920	186	235	68
1970	12,666,240	212	235	130
Average of 1969 and 1970	9,312,080	199	235	98

The large increase in the transmissivity (over 90 percent) and ground-water discharge (over 100 percent) from 1969 to 1970 was accompanied by a rather small increase (about 2 feet, or 0.6 m) in the average saturated thickness of the ground-water reservoir.

Another estimate of the transmissivity of the Wissahickon Formation was made from the specific capacities of 72 wells drilled in this formation in the study area. This estimate was made from a chart given by R. R. Meyer (in Bentall, 1963, p. 339) that relates well diameter, specific capacity, storage coefficient, and the coefficient of transmissibility. The coefficient of transmissibility that corresponds to the values on Meyer's chart is about 780 gallons per day per foot (gpd/ft) (9,700 (l/d)/m). A transmissivity value of 104 feet squared per day (ft^2/d) (9.66 m^2/d) is obtained by dividing 780 gpd/ft by 7.48 (the number of gallons in 1 cubic foot of water).

Even though there are many sources of error in these methods of estimating rock transmissivity (Olmsted and Hely, 1962, p. 18-20), the average transmissivity value in the table above (98) and that estimated from the chart in Bentall (1963) (104) compare favorably with one another and are probably fairly accurate. However, because of the great variability in the water-bearing characteristics of fractured rocks, the estimated transmissivities of the Wissahickon Formation in York County are only an indication of the average transmissivity and not an exact guide for well spacing or for predicting the movement of ground water in any local area.

Available data are inadequate to permit estimates of the transmissivity of the other rocks throughout the study area in the same manner.

AVAILABILITY

The availability of ground water in the area depends on the capacity of the rocks to store and transmit water. An estimate of the transmissive and storage characteristics of the rocks is generally made by test pumping a well and measuring the discharge from the pumped well and the effect of pumping on the water level in one or more nearby observation wells. Frequently the observed data are then substituted into one of the equations of well hydraulics (Ferris and others, 1962; Bentall, 1963; Walton, 1962), which is then solved for the appropriate aquifer properties. This approach was not followed in the present study, as the simplifying assumptions made in deriving the equations of well hydraulics are generally not satisfied in the aquifers of the study area. Transmission of water in these aquifers occurs through secondary openings such as fractures and solution cavities, and is usually dissimilar to flow through a uniform porous medium.

Aquifer tests made on similarly constructed, closely spaced wells in the area indicate that the amount of water yielded to the wells by the rocks may easily differ by a factor of 10 over distances no greater than a few tens of feet. (See yield and drawdown information in Table 17 for wells Yo-249, 250, and 253.) In the carbonate rocks a larger factor is entirely possible. Thus, a great difference in the transmitting and storage properties of the rocks can exist over very short distances, because one unit cross-sectional area may have many fractures (or one large fracture) through which water flows, while another may have none (or only a few small fractures).

These variations make it very difficult to interpret the meaning of water-level changes that may occur in an observation well during any aquifer test made in the area. All other things being equal, small amounts of water-level drawdown in an observation well caused by a nearby pumping well may be incorrectly interpreted as a reflection of high transmissivity in the rocks, when in fact it may reflect nothing more than a poor hydrologic connection between the two wells.

A great deal more information than is available about the physical character of the fractured rock is usually needed to correctly interpret water-level changes in observation wells caused by nearby pumping. Consequently, in most of the 255 aquifer tests made to evaluate the availability of ground water in the study area, measurements of water level were made in pumped wells only.

Specific Capacity as a Measure of Availability

The specific capacity of a well is defined as the well discharge, in gallons per minute, divided by the amount of drawdown or water-level

decline, in feet, caused by continuous pumping for some period of time.

$$\text{Specific capacity} = \frac{\text{Well discharge (gpm)}}{\text{Drawdown or water-level decline (ft)}}$$

Theoretically the specific capacity of a well is directly related to the capacity of the rocks to store and transmit water to wells (Bentall, 1963). However, before specific-capacity data can be used to make a realistic estimate of the amount of ground water available to wells, or the potential yield of wells, it is necessary to evaluate the factors that affect specific capacity.

Factors That Affect Specific Capacity

Analysis of the data reveals that many factors affect the specific capacities of wells in the area. The most important factors and their effects are discussed in the following sections.

Topography

All the wells inventoried during the investigation were placed in one of four categories that best describe their topographic position. The four categories are hilltop, slope or hillside, creek valley or river valley, and draw or gully on the hillsides (see Table 17 and Plate 1). A comparison of the specific capacities (most determined from 1-hour aquifer tests) of all the tested wells in each of these topographic positions shows that topography generally has a significant effect on the specific capacity of the wells. The following table shows that the highest median specific capacities were obtained from wells in valley and draw positions, respectively, and the lowest were obtained from wells in hilltop and slope positions.

Number[1] of wells	Topography	Specific capacity (gpm/ft)	
		Range	Median[2]
49	Valley	0.04 – 93	0.88
27	Draw	.04 – 28	.64
115	Slope	.03 –780	.49
64	Hilltop	.04 – 15	.45

[1] All tested wells included regardless of rock type.

[2] Median (half the values are above and half are below this figure).

The influence of topography on specific capacity is caused by some combination of the following factors: (1) The valleys and draws are un-

derlain by rock that is less resistant to erosion and is more permeable than the rock forming the hilltops and hillsides. (2) The saturated thickness of the regolith and, therefore, the amount of water in storage in the ground-water reservoir are generally greatest in the valleys and draws and least on the hillsides and hilltops.

The median saturated thickness of the regolith associated with various topographic positions was estimated to be equal to the difference between the median casing depths (assumed to represent median regolith thickness) and the median water levels below land surface. The following table shows the relationship between estimated saturated thickness of the regolith and specific capacity. The saturated thickness of the regolith, as defined above, ranges from 0 on hilltops to 20 feet (6 m) in valleys. The data indicate that the thicker the saturated regolith, the greater the median specific capacity of wells.

Number[1] of wells	Topography	Casing depth (feet)	Water level below land surface (feet)	Estimated saturated regolith thickness (feet)	Specific capacity (gpm/ft)
		Median	Median	Median	Median
25	Valley	29	9	20	1.25
19	Draw	26	15.5	10.5	.56
82	Slope	30	29	1	.44
35	Hilltop	26	44.5	0	.44

[1] All tested wells included, regardless of rock type, where casing depth was known.

Because of the other factors mentioned above that influence the relationship between topography and specific capacity, it is not possible to estimate the exact effect of saturated regolith on specific capacity from this data. However, the saturated regolith generally stores more water per unit volume than the underlying fractured bedrock (see section entitled "Specific Yield"). When wells completed in the fractured bedrock are pumped, water in the regolith within the influence of pumping moves into the bedrock and toward the well to help replace the withdrawals and sustain the yield.

Rock Type

The ability of the rocks in the area to store and transmit water differs between general rock types from one formation to another and within each formation. The specific capacities of wells in the carbonate rocks range from less than 0.04 to about 40 gpm per foot of drawdown (0.008

to 8.3 (l/s)/m) and have a median of 0.90 (0.19 (l/s)/m). The specific capacities of the wells in the noncarbonate rocks range from about 0.04 to about 6.3 (0.008 to 1.3 (l/s)/m), with a median of 0.48 (0.10 (l/s)/m). These data indicate that the specific capacity of wells in the carbonate rocks is much more variable than for wells in the noncarbonates, and that the carbonate rocks as a group have a greater potential than the noncarbonates for the development of high-yielding wells. The large number of high-specific-capacity wells in the carbonate rocks is due to the enlargement of most of the water-bearing zones in these rocks by solution activity.

The Ledger and Conestoga Formations contain most of the high-specific-capacity carbonate wells. The Kinzers and Vintage Formations, on the other hand, have wells of lower specific capacity than most of the wells in the noncarbonates.

The major water-bearing formations are ranked in order of decreasing median specific capacity in Table 6. The last column in Table 6 was prepared from a study of the trend of the water level during the 1-hour specific-capacity tests. When the water level declines at an increasing rate with the logarithm of time, it is generally assumed that the cone of influence of pumping has intercepted a zone having lower transmissivity. Such an increasing rate of water-level decline is generally encountered less frequently in rocks that yield large amounts of water and contain high-specific-capacity wells than in rocks that yield small amounts of water and contain low-specific-capacity wells. A comparison of the last two columns in the table shows that this is generally true except for the Conestoga Formation.

Many of the tested wells in the Conestoga intercept large, shallow yielding zones that are poorly connected. These zones store large amounts of water and can sustain rather large yields for short periods of time. However, the poor connection between these zones limits and retards the movement of water, and with sustained pumping there is a gradual dewatering of the shallow yielding zones intercepted by the wells. The rank of the median specific capacity of the wells in the Conestoga would probably be somewhat lower if the wells in all the aquifers had been pumped for longer periods (1 day or more) so that isolated shallow zones, such as those in the Conestoga, were emptied.

Depth and Yield of Water-Bearing Zones

Table 7 shows the reported depth and yield of water-bearing zones in wells penetrating the formations in the study area. The data are meager but do suggest a general decrease in both the number and the yield of the water-bearing zones as depth below the water table increases. Few water-

Table 6. *Median Specific Capacities of Wells in the Major Bedrock Aquifers of Central and Southern York County and Southeastern Adams County*

Aquifer	Dominant rock type	Number of wells tested	Median specific capacity after 1 hour	Percent of 1-hour tests in which water levels decline at an increasing rate with the logarithm of time
Ledger Formation	Dolomite	10	6.4	30
Conestoga Formation	Limestone	32	1.3	46
Wissahickon Formation	Schist	72	.95	32
Peters Creek Schist	Schist	7	.70	33
Harpers Formation	Phyllite	27	.39	41
Kinzers Formation	Shale	6	.35	50
Chickies Formation	Slate and quartzite	21	.34	53
Marburg Schist	Schist	37	.28	56
Vintage Formation	Dolomite	9	.16	56
Antietam Formation	Quartzite	11	.12	55
Kinzers Formation	Limestone	10	.06	50

Table 7. *Reported Depth and Yield of Water-Bearing Zones in Wells Penetrating Fractured-Rock Aquifers in Central and Southern York County*

Aquifer or formation	Depth interval below the water table (feet): 0–50	51–100	101–150	151–200	201–250	251–300	301–350	351–400	401–650	Zones for which data were reported	Number of wells
Noncarbonate rocks											
Antietam Formation											7
Average number of zones[1]	1.2	1.2	0	0	[b]					12	
Average yield of zones[2]	8	7								10	
Chickies Formation											11
Average number of zones[1]	1.1	1.0	1.0	1/29[a]						21	
Average yield of zones[2]	13	4	2							19	
Harpers Formation											56
Average number of zones	1.1	.8	.7	2.1	1/34[a]					103	
Average yield of zones	6	8	4	3						92	
Kinzers Formation (shale)											5
Average number of zones	.8	.7	.5	0	0	0	0	1.0	[b]	8	
Average yield of zones	10	4								6	
Marburg Schist											46
Average number of zones	1.0	.6	.5	0	0	0	0	1.0	[b]	78	
Average yield of zones	4	4	3							74	
Wissahickon Formation											12
Average number of zones	.8	.8	1.2	.3	0	.4	.4	0	[b]	21	
Average yield of zones	17	8								17	
Carbonate rocks											
Conestoga Formation											16
Average number of zones	.9	.7	.5	0	0	0	0	[b]		25	
Average yield of zones	24	21	14							23	
Ledger Formation											3
Average number of zones	.3	.4	1.6	0	0	1/47[a]				4	
Average yield of zones											
Vintage Formation											7
Average number of zones	1.2	.6	.9	[b]						12	
Average yield of zones	6	12	2							12	

[1] Average number of zones per 50 feet of depth interval drilled.
[2] Average of reported yield of zones (in gallons per minute).
[a] Zone was reported but less than 50 feet was drilled in depth interval. The accompanying fraction indicates the number of zones reported over the number of feet drilled.
[b] Less than the total footage of depth interval was drilled and no zone was reported.

bearing zones were reported more than 150 feet (45 m) below the water table in wells in the Antietam and Conestoga Formations, the Marburg Schist, and the shale of the Kinzers Formation. Water-bearing zones below this depth were reported to occur most frequently in wells in the Harpers, Ledger, and Wissahickon Formations.

Data exist to support the reported occurrence of water-bearing zones, at least for the Wissahickon and Conestoga Formations.

The municipal-industrial wells in the Wissahickon have a median specific capacity of about 2 (0.4 (l/s)/m) and a median depth of 200 feet (60 m). The domestic wells have a median specific capacity of about 0.6 (0.1 (l/s)/m) and a median depth of 107 feet (33 m). The deeper wells in the Wissahickon have apparently intercepted more yielding zones than the shallower wells. Thus, there is an excellent chance of increasing the specific capacity of a shallow well in the Wissahickon by drilling deeper. Drilling to depths as much as 350 feet (110 m) below the water table may be warranted (see Table 7).

The municipal-industrial wells in the Conestoga have a median specific capacity of about 2 (0.4 (l/s)/m) and a median depth of 285 feet (87 m). The domestic wells also have a median specific capacity of about 2 (0.4 (l/s)/m), but they have a median depth of only 130 feet (40 m). The deeper municipal-industrial wells in the Conestoga apparently intercept no more water-bearing zones than the shallower domestic wells. Thus, the data indicate that there is little chance of improving the specific capacity of a well in the Conestoga Formation by drilling to depths greater than about 150 feet (45 m) below the water table (see Table 7).

The specific capacity of any well that obtains the major part of its water from a shallow yielding zone decreases substantially when the zone is dewatered or is in the process of being dewatered.

Water-bearing zones intercepted by wells may be partly or completely dewatered in the zone of seasonal or longer term water-table fluctuation. Ground-water levels in the area generally decline from late spring to late fall, when discharge from the ground-water reservoir exceeds recharge. Conversely, they generally rise in the winter and early spring, when recharge exceeds discharge.

The amount of fluctuation depends on the hydrologic setting of the well and the prevailing weather conditions. When only small amounts of ground-water recharge occur (as in 1969), the water levels are lower and the fluctuations are smaller than when large amounts of recharge occur (as in 1970). Annual water-level fluctuations in the area range from less than 5 feet (1.5 m) in wells near perennial streams (where water levels are about 10 feet (3 m) or less below land surface) to more than 30 feet (9 m) in wells near ground-water divides (where water levels range between about 35 and 65 feet (10 and 20 m) below land surface).

Table 8 shows how seasonal water-level fluctuations affect the specific capacities of some wells in the study area.

The data show that the specific capacities of these wells are lowest when the static water levels are low. It is logical to assume that this effect is general throughout the area, that it is most intense where major water-bearing zones are within the zone of water-table fluctuation, and that the intensity of the effect decreases with increasing depth to major water-bearing zones.

In a well in which water is supplied from a single zone, the maximum effective hydraulic gradient is obtained when the water level is drawn down to that zone. As pumping continues and water is drawn from more distant parts of the aquifer, the gradient and, consequently, the yield of the water-bearing zone will generally decline. The rate of water-level decline will increase as the water level falls below the zone and water is taken from storage in the borehole. The effect is a decrease in the specific capacity of the well.

Pumping large amounts of water to effect a lowering of the water table will dewater many water-bearing zones and will, therefore, affect the specific capacity of wells found within the influence of such pumping. All mining and quarrying operations in the study area that are deeper than the natural water table require some pumping to keep from being inundated. Most of these operations are found in the York-Hanover valley and involve the excavation of limestone and dolomite primarily from the Kinzers, Ledger, and Vintage Formations.

Figure 4 shows the general magnitude and extent of the effect of quarry and mine pumping on the water table in the area around Thomasville, Pennsylvania. The map was prepared from water-level measurements made in 22 wells from July 9 to 13, 1971. Pumpage from the quarry at this time was reported to be about 2 mgd (million gallons per day) (7,600 kl/d) or about 1,500 gpm (95 l/s). Water-table altitudes in this area probably ranged between about 425 and 450 feet (130 and 140 m) above mean sea level before the excavation of the limestone and dolomite and before the pumping from the excavations began. Estimates are that the water table has been lowered in the rocks at least 100 feet (30 m) near the center of the operation. Small effects of this dewatering can be measured in wells as much as 1 mile (1.6 km) west and southwest of the quarry, in the areas underlain by carbonate rocks.

The low median specific capacity of wells tested in the Vintage Formation and in the limestones of the Kinzers Formation can be explained, at least in part, by the fact that some of the wells are within the influence of quarry and mine pumping.

Table 8. *Effect of Seasonal Water-Level Fluctuations on the Specific Capacities of Four Wells in Central and Southern York County*

Well	Formation	Test data	Test length: Minutes	Test length: Days	Static water level (feet below land surface)	Water level decline[a] (feet)	Pumping rate[b] (gpm)	Specific capacity (gpm/ft dd)
Yo-241	Conestoga	Mar. 1968	90	—	18	12	24	2.00
		Oct. 1962	90	—	30	75	28	.37
Yo-239	Peach Bottom	Apr. 1969	—	7	50	38	35	.92
		Oct. 1969	—	7	80	60	26	.43
Yo-231	Wissahickon	Apr. 1970	—	9.3	0	55	85	1.55
		Oct. 1969	—	3.5	9	80	80	1.00
Yo-226	Wissahickon	Feb. 1971	—	48	25	32	72	2.25
		Nov. 1969	—	38	32	62	51	.83

[a] Drawdown total
[b] Average rate of pumping during test

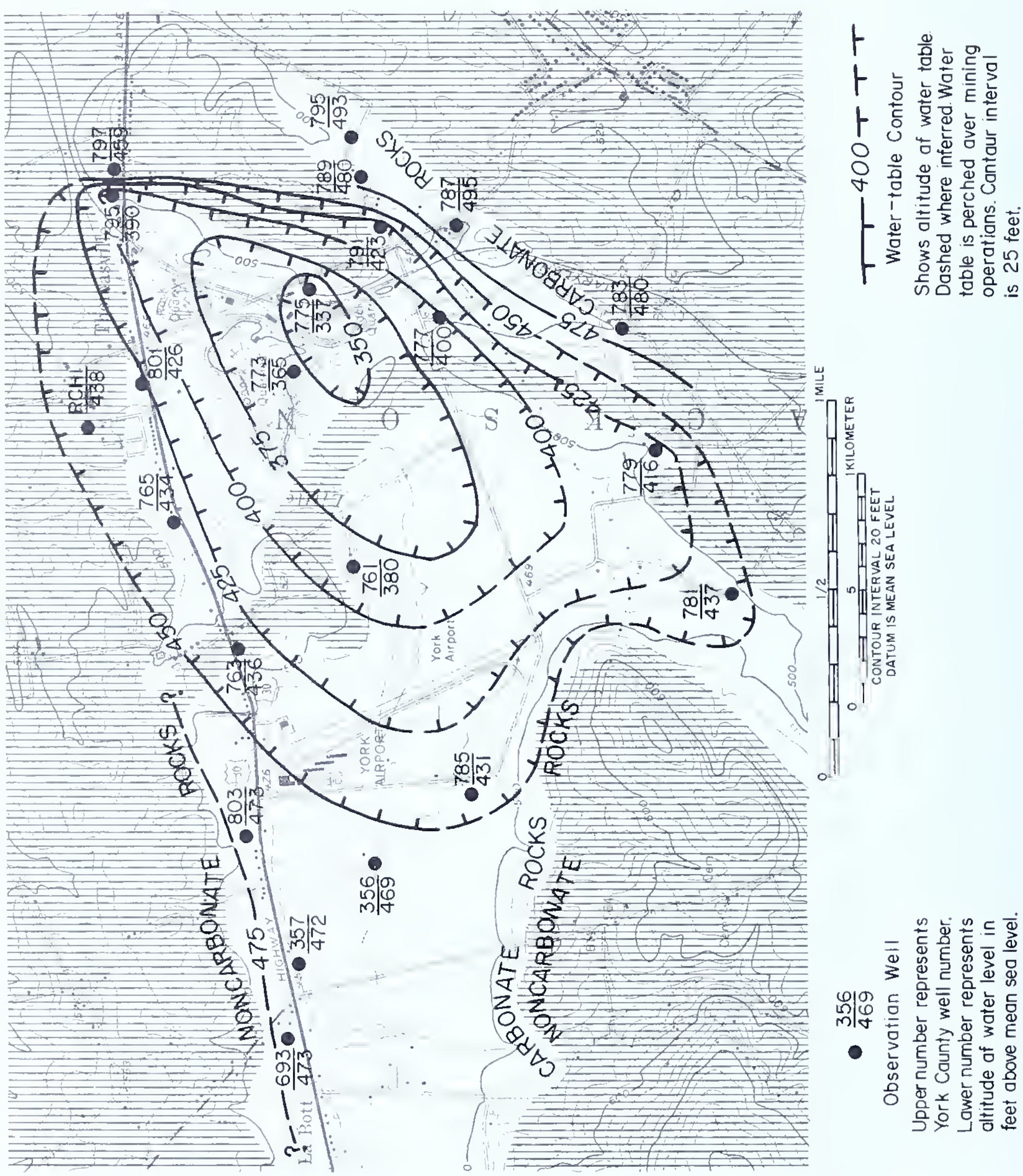


Figure 4. Map showing the approximate shape of the water table for the period July 9 to 13, 1971, and areas of carbonate and noncarbonate rock near Thomasville, Pennsylvania.

Pumping Rate and Duration

Pumping rate and the length of continuous pumping affect the specific capacity of most wells in the area. When wells are pumped at low rates (10 gpm (0.63 l/s) or less), the flow of water through the rocks and into the wells is slower and more apt to be laminar and efficient than at higher pumping rates. High pumping rates result in a more rapid flow of water through the zones, and into the well. The restricted nature of most of the yielding zones causes frictional resistance to the rapid movement of water, and inefficient turbulent flow may sometimes occur, particularly where the water enters the well. Turbulent flow also may occur where water passes rapidly through the small annular space between the wall of the borehole or casing and the pump mechanism. Turbulent flow results in more drawdown than laminar flow at similar pumping rates.

Large increases in pumping rate may introduce or increase turbulent flow in most wells in the area. Thus, doubling the pumping rate may more than double the drawdown, and the specific capacity may be reduced accordingly. Table 9 shows the effect of pumping rate on the 1-hour specific capacities of six wells in the study area. The exact amount of the effect differs from well to well, but on the average the drawdown was increased by a factor of 3.6 when the pumping rate was increased by a factor of about 2, and the specific capacity was reduced by about one third.

When a well is pumped, the water level declines in the well and in the rocks around the well. As pumping continues, a larger and larger area is affected by water-level decline as water is drawn from increasing distances to replace the water pumped from the well. As the areal effect of pumping continues to grow, the water level declines so that the specific capacity of the well is decreased. The water level will continue to decline and the specific capacity will continue to decrease until (1) recharge to the aquifer has been increased by an amount equal to the pumping rate, (2) the natural discharge from the aquifer has been decreased by an amount equal to the pumping rate, or (3) the sum of the increased recharge and decreased natural discharge is equal to the pumping rate.

Figure 5 shows how the averages of specific capacities for selected wells in the Ledger, Wissahickon, Harpers, and Conestoga Formations and the Marburg Schist decreased as pumping time increased. Specific capacities were calculated for each well and averaged by formation after 1, 2, 4, 8, 12, and 24 hours of pumping when information was available.

The 1-hour specific capacities plotted on the graph are as large or larger than the median 1-hour specific capacities for all the wells tested in each of these formations. Average decreases in specific capacity with continuous pumping, similar to those on the graph, can probably be

Table 9. *Effect of Pumping Rate on the Specific Capacities of Six Wells in Central and Southern York County and Southeastern Adams County*

Formation	Well number		Time pumped (hours)	Yield (gpm)	Drawdown (feet)	Specific capacity (gpm per foot of drawdown)	Static water level below land surface (feet)
Wissahickon	Yo-233	Test 1:	1	24.5	14.5	1.7	30
		Test 2:	1	110	84	1.3	25
		Percent increase (+) or decrease (−)	0	+350	+480	−24	+17
	Yo-473	Test 1:	1	10	6.7	1.5	7.8
		Test 2:	1	24	24	1.0	8.1
		Percent increase (+) or decrease (−)	0	+140	+260	−33	−3.5
Conestoga	Ad-208	Test 1:	1	12.3	4.8	2.6	21.8
		Test 2:	1	23	16.8	1.4	21.8
		Percent increase (+) or decrease (−)	0	+93	+250	−46	0
	Yo-470	Test 1:	1	8.5	.3	28.3	28.6
		Test 2:	1	20	1.1	18.1	28.2
		Percent increase (+) or decrease (−)	0	+135	+270	−36	+1.5

	Yo-728		Test 1:	1	25	20.5	1.2	21
			Test 2:	1	29	27	1.07	21
Harpers		Percent increase (+) or decrease (−)		0	+16	+32	−11	0
	Yo-814		Test 1:	1	60	20	3.0	10
			Test 2:	1	89	88	1.0	9
		Percent increase (+) or decrease (−)		0	+50	+340	−67	+10
	Medians	Percent increase (+) or decrease (−)		0	+114	+265	−34	+0.8

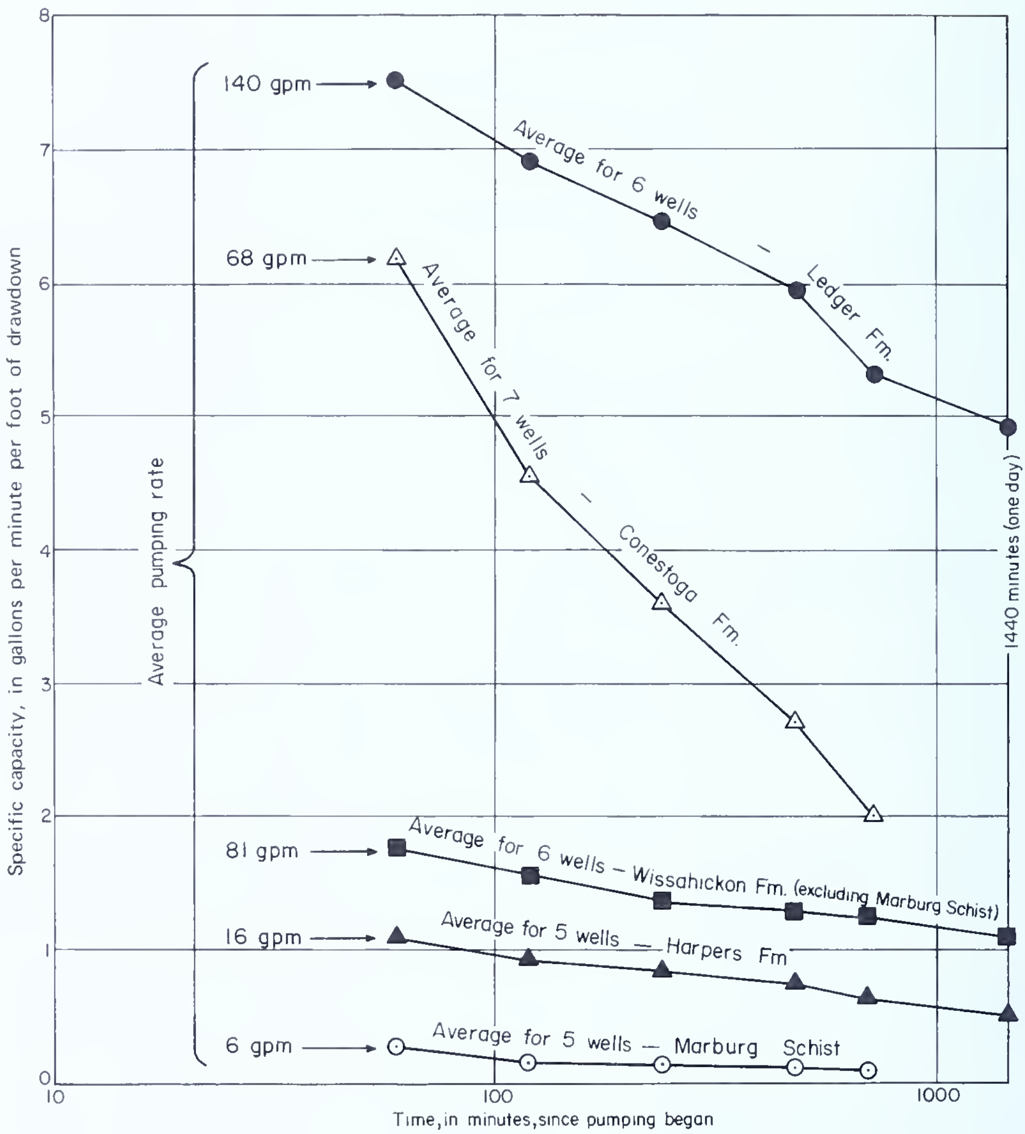


Figure 5. Graph showing the relationship between pumping time and the average specific capacities of selected wells in the Ledger, Conestoga, Wissahickon, and Harpers Formations, and the Marburg Schist, central and southern York County.

expected for average to better-than-average wells in each of the formations tested. Poor wells would probably show more drastic decreases in specific capacity.

Well Interference

When wells in the area are closely spaced and pumped simultaneously, the areas influenced by their pumping may overlap and they may compete

for some of the same ground-water supplies. When such competition or interference occurs, additional amounts of drawdown are needed to maintain the well discharge established before interference. Consequently, there is a decrease in the specific capacity of the wells. Such well interference should be reduced as much as possible to insure maximum well efficiency.

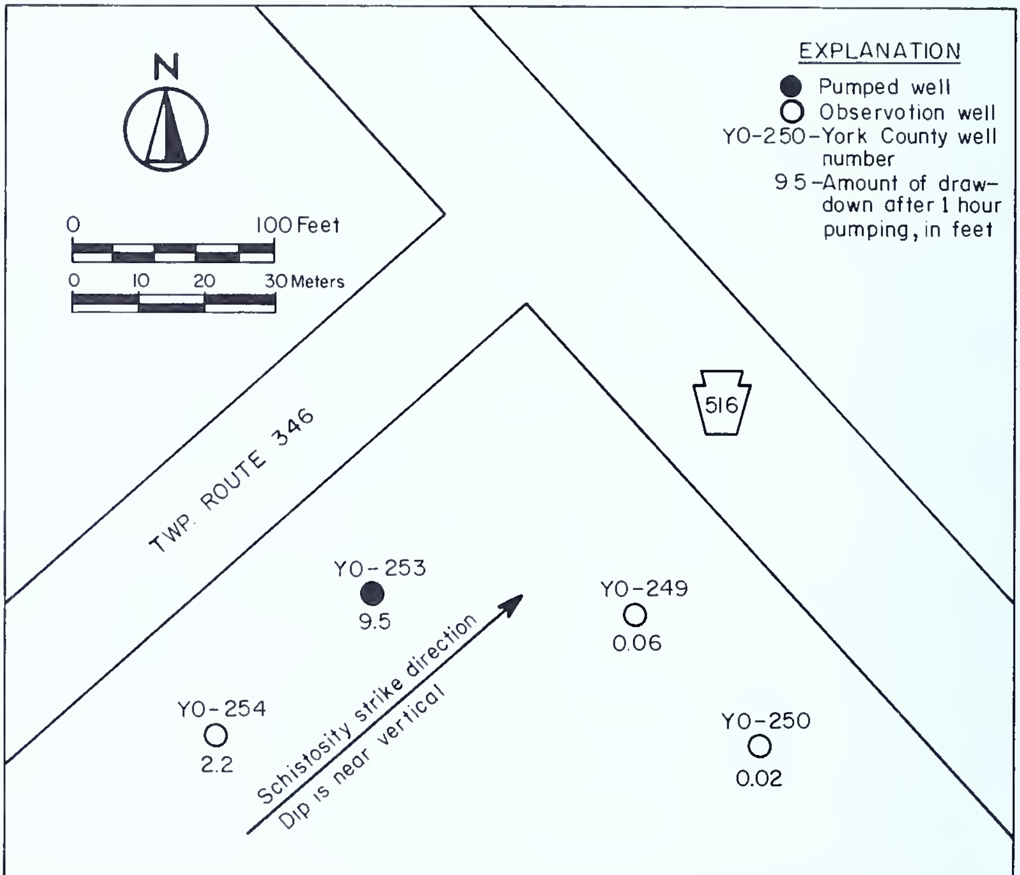
Generally well interference increases as the distance between wells decreases; and in fractured bedrock aquifers interference is generally greatest along some preferred direction. Meisler and Longwill (1961) noted that wells arranged in a line perpendicular to the strike of bedding in the rocks are less likely to interfere with one another (and can therefore be spaced closer together) than wells arranged in a line parallel to the strike.

Figure 6 shows a relationship similar to that described above between well interference and the strike of schistosity in the Marburg Schist. Well Yo-253 was pumped at about 12 gpm (0.76 l/s) for 1 hour. The greatest water-level decline in the observation wells (2.2 feet, or 0.67 m) occurred in well Yo-254. This well and the pumped well are along a line that parallels the strike of schistosity. The least water-level decline (0.06 and 0.02 foot, or 0.02 and 0.006 m) occurred in observation wells Yo-249 and Yo-250. These wells and the pumped well are along a line that is nearly perpendicular to the strike of the schistosity. The water-level declines that occurred in wells arranged perpendicular to schistosity were about 35 to 110 times less than the water-level decline that occurred in wells arranged parallel to schistosity.

The direction of the strike of schistosity, bedding, and major jointing exerts considerable control on both the surface drainage and the occurrence and movement of ground water throughout the area. Maximum well interference is probable when wells are arranged close together along a line that parallels the northeast strike of schistosity or bedding, or the north-northwest to northwest strike of the major jointing in the area.

Estimated Potential Well Yield from Specific Capacity

Table 10 shows the estimated potential yield for wells in all the formations where adequate specific-capacity information was obtained. The 1-hour specific capacities shown in Table 5 were adjusted for 24-hour continuous pumping by the percent reduction in specific capacity indicated in Figure 5. The 1-hour specific capacity was reduced 33 percent for wells in the Ledger and Wissahickon Formations, 55 percent for wells in the Harpers Formation, and 70 and 75 percent for wells in the Marburg Schist and Conestoga Formation, respectively. The specific capacities of wells in the other formations were decreased by the average



The intersection of township road 346 with Pa. Route 516 is located about 2 miles southeast of Jefferson, Pa. The area is underlain entirely by the Marburg Schist. All wells are 6 inches in diameter and range from 115 to 140 feet in depth.

Figure 6. Map showing the relationship between drawdown in wells and the strike of steeply dipping schistosity in the Marburg Schist, York County.

of these reduction factors, or about 50 percent. The estimated potential yields were calculated by multiplying the reduced specific capacities by 50 feet (15 m) of available drawdown.

The amount of available drawdown will differ from well to well. In any one formation, the differences will depend mainly on the depth to the major water-bearing zones intercepted by the wells. Generally a well with major water-bearing zones deeper than 50 feet (15 m) below the water table will have more available drawdown and, therefore, a better chance of obtaining the higher potential yields shown for the respective formation in the table. A well with major water-bearing zones shallower than 50 feet (15 m) below the water table will have less available drawdown and, therefore, a poorer chance of obtaining the higher potential yields shown for the respective formation in the table.

Table 10. *Estimated Potential Well Yield for the Major Bedrock Aquifers of Central and Southern York County and Southeastern Adams County after 24 Hours of Pumping*

Aquifer or formation	Estimated potential well yield in gallons per minute				
	15 percent[1]	25 percent[1]	50 percent[1]	75 percent[1]	85 percent[1]
Carbonates					
Conestoga	350	140	18	6	3
Kinzers (limestone)	65	11	2	2	1
Ledger	700	400	215	6	3
Vintage	175	40	4	2	1
Noncarbonates					
Antietam	35	11	3	2	1
Chickies	200	55	8	3	1
Harpers	25	16	9	3	1
Kinzers (shale)	125	65	9	2	1
Marburg	20	14	5	2	1
Peters Creek	80	70	18	5	1
Wissahickon[2]	150	80	32	7	4

[1] Percentage of wells in which indicated yield is equaled or exceeded.
[2] Excluding the Marburg Schist.

Wells in valleys or draws drilled to depths between 150 and 400 feet (45 and 120 m) below land surface (see section entitled "Summary of Water-Bearing and Water-Quality Characteristics of the Bedrock Aquifers" for appropriate well depth) will have the best chance of obtaining the highest potential yields.

RELATION BETWEEN FRACTURE TRACES AND THE AVAILABILITY OF GROUND WATER

Fracture traces have been defined by Lattman (1958, p. 569) as natural linear features consisting of topographic (including straight stream segments), vegetational, or soil-tonal alignments, which are visible primarily on aerial photographs and are expressed continuously for less than 1 mile (1.6 km).

Fracture traces are believed to be the surface expression of vertical or nearly vertical fractures (individual joints, zones of closely spaced joints, or small-scale faults) in the underlying bedrock. The relationship between fracture traces and underlying water-bearing zones of above average permeability was examined in the study area.

Five fracture-trace sites (two in the Wissahickon Formation and three in the Conestoga Formation) were selected for test drilling. The features

that were drilled consisted of single fracture traces that were easily recognizable on aerial photographs. The depth of the test wells, which are 6 inches (15 cm) in diameter, was limited to near the median depth of preexisting inventoried wells adjacent to each test site area (Table 11). The amount of casing used in each test well was determined by on-site drilling conditions.

Table 11. *Characteristics of Test Wells and Preexisting Wells Adjacent to Test Areas*

Well	Well depth (feet)	Casing depth (feet)	1-hour specific capacity (gpm per foot of drawdown)	Static water level (below land surface) (feet)	Pumping rate (gpm)
		Wissahickon Formation			
Test well Yo-472	125	50	0.17	16	7
Yo-473	120	47	1.5	8	10
Preexisting wells in area[1]	110[a]	30[b]	.10[c]	56[c]	6[c]
		Conestoga Formation			
Test well Yo-469	125	21	.035	13	4
Yo-470	42[d]	42	28	27	9
Yo-471	160[e]	24	.14	28	8
Preexisting wells in area[2]	110	23[f]	9.3[g]	28[h]	9[g]

[1] Wells Yo-494, 495, 496, 497, 498, 499, 522, 523, 540, 541, 542, 543, 544, 545

[2] Wells Yo-291, 292, 293, 294, 295, 296, 488, 489, 491, 493

[a] Median of 14 wells

[b] Median of 9 wells

[c] Median of 6 wells

[d] Initially 120 feet deep; filled in to 50 feet deep before pumping test; 42 feet deep after pumping test

[e] Deepened to 160 feet after specific-capacity test

[f] One well

[g] Median of 5 wells

[h] Median of 8 wells

Four of the five fracture traces on which test wells were drilled (Yo-469, 471, 472, and 473) have topographic expression in the field. The trace associated with test well Yo-473 is in the bottom of a prominent valley, but the traces on which the other three wells were drilled are associated with much subtler surface drainage features (Figure 7). The fracture trace associated with well Yo-470 is without topographic expression. Although a small depression is present in the vicinity of the well site, this depression is most likely the northern extension of the prominent draw south of the well.

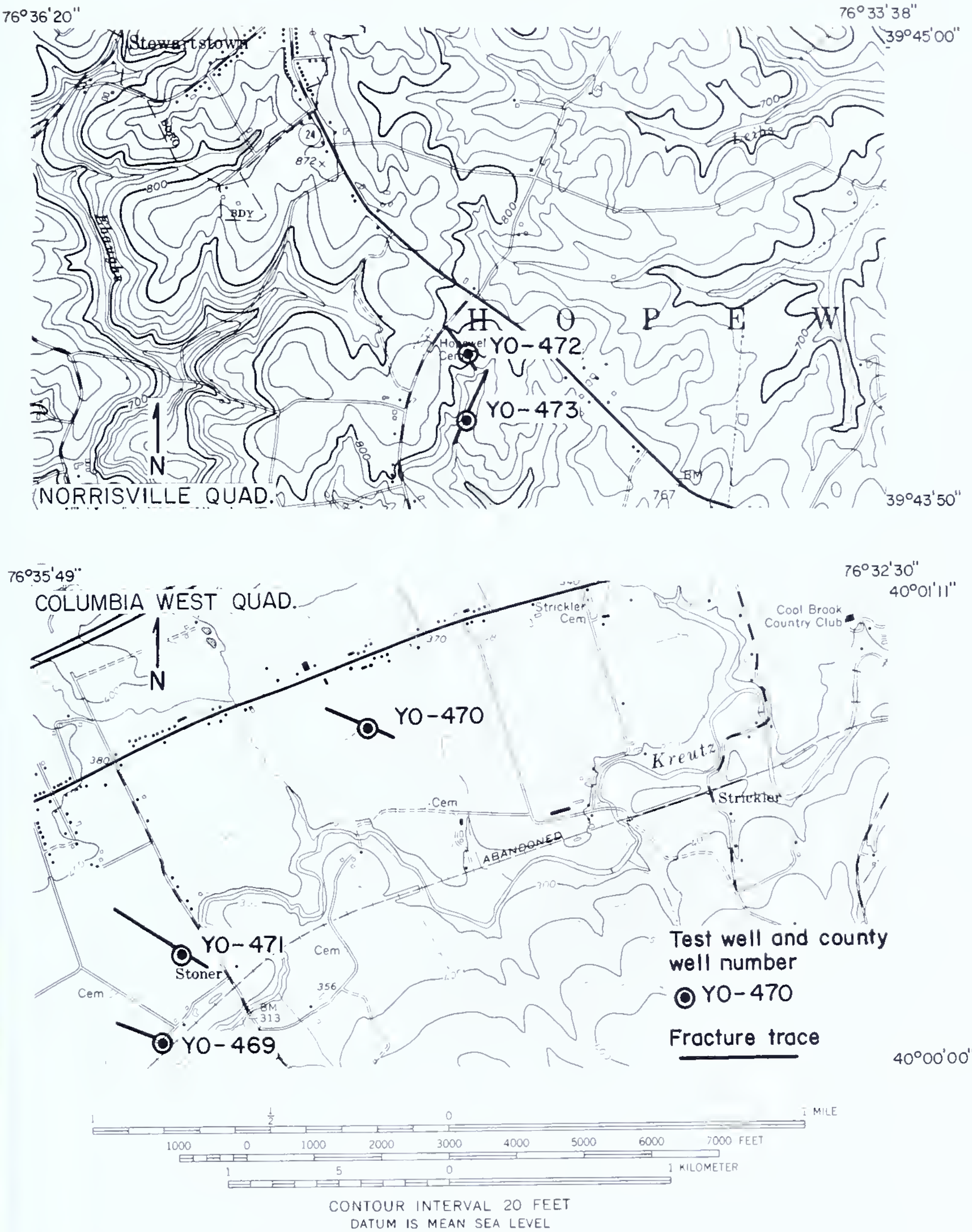


Figure 7. Maps showing locations of test wells and associated fracture traces, York County.

Evidence of extensive fracturing was observed during the drilling of wells Yo-470, 471, and 473 only. Chunks of rock and rock material up to 4 by 2½ by 1 inch (10 × 6 × 2.5 cm) in size were recovered from all these wells during drilling. Some of these fragments were iron stained and

deeply weathered. In addition, lost circulation, rapid bit penetration, and borehole fill-up and collapse, which occurred during the drilling of test wells Yo-470 and 473, suggest extensive fracturing in the subsurface at these sites.

Comparison of the specific capacities of the test wells with the median specific capacity of the preexisting wells in each test area indicates that two of the test wells (Yo-470 and 473) positively penetrated water-bearing zones of above average permeability (Table 11). Assuming that all five wells were located accurately on the fracture traces, it appears that some of the traces have hydrologic significance and some are superficial features that are unrelated to water-bearing zones of high permeability, at least to the depths to which the test wells were drilled. Data are insufficient to distinguish those features that have hydrologic significance. Additional evaluation of fracture traces is needed.

QUALITY OF GROUND WATER

The quality of ground water in the study area is determined primarily by the physical and chemical properties of the regolith and bedrock through which the water moves and the length of time the ground water has been in contact with these materials. In addition to these natural controls on ground-water quality, human-related activities such as on-lot sewage disposal and use of fertilizers on cropland may significantly affect the quality of ground water in the area. The source and significance of the constituents and properties of ground water are given in Table 12.

Evaluation of the quality of ground water in the study area is based on data collected at approximately 400 well sites. These data consist of field determinations of specific conductance, hardness, pH, and temperature, and of laboratory chemical analyses of 92 water samples.

Field Determinations

Hardness, pH, and Specific Conductance

A summary of the field determinations of specific conductance, hardness, and pH is given by aquifer in Table 13. The field specific conductance ranged from less than 50 to 1,500 micromhos. Water from each carbonate-rock aquifer had a median specific conductance of 410 micromhos or more, and water from each noncarbonate-rock aquifer had a median specific conductance of 330 micromhos or less. Only water from the Vintage Formation, of all the carbonate-rock aquifers, had a median specific conductance less than 500 micromhos. Further, of all the noncarbonate-rock aquifers, only the Harpers Formation and the shale of the

Table 12. *Source and Significance of Selected Dissolved Constituents and Properties of Ground Water*

(Concentrations in milligrams per liter (mg/l) except as indicated)

Constituent or property	Source or cause	Significance
Silica (SiO_2)	Dissolved from practically all rocks and soils (commonly less than 30 mg/l).	Forms hard scale in pipes and boilers. When carried over in steam of high pressure boilers it forms deposits on blades of turbines.
Iron (Fe)	Dissolved from practically all rocks and soils. May also be derived from iron pipes, pumps, and other equipment.	On exposure to air, iron in ground water oxidizes to reddish-brown precipitate. More than about 0.3 mg/l stains laundry, porcelain, and utensils reddish brown. Objectionable for food processing, textile processing, beverages, ice manufacturing, brewing, and other processes. Maximum limit recommended for drinking water is 0.3 mg/l.[1]
Manganese (Mn)	Dissolved from many rocks and soils. Often found associated with iron in natural waters but not as common as iron.	More than 0.2 mg/l precipitates upon oxidation. Manganese has the same undesirable characteristics as iron but is more difficult to remove. Maximum limit recommended for drinking water is 0.05 mg/l.[1]
Cadmium (Cd)	Dissolved in small quantities from cadmium-bearing rocks. Excessive concentrations are generally from contamination by industrial wastes from metal-plating operations.	Concentrations above 0.01 mg/l may be toxic and are considered grounds for the rejection of a water supply.
Chromium (Cr)	Dissolved in minute quantities from chromium-bearing rocks. Excessive concentrations are generally from contamination by industrial wastes.	Maximum limit recommended for drinking water is 0.05 mg/l.[1]

Table 12. *Continued*

Constituent or property	Source or cause	Significance
Copper (Cu)	Dissolved from copper-bearing rocks. Small amounts (less than 1.0 mg/l) generally found in natural waters. Small amounts are commonly added to water in reservoirs to inhibit algal growth.	Copper is essential and beneficial for human metabolism. May impart metallic taste to water in concentrations greater than 1.0 mg/l. Maximum limit recommended for drinking water is 1.0 mg/l.[1]
Lead (Pb)	Dissolved in small quantities from lead-bearing rocks. Less than 0.01 mg/l generally found in natural waters. Excessive concentrations are caused by contamination from such things as lead plumbing, lead picked up from the atmosphere by rain, etc.	Lead is accumulated by the body and causes sickness and even death in excessive concentrations. Maximum limit recommended for drinking water is 0.05 mg/l.[1]
Zinc (Zn)	Dissolved from zinc-bearing rocks. May be dissolved from galvanized pipe and is present in many industrial wastes.	Concentrations greater than 30 mg/l have been known to cause nausea and fainting and may impart metallic taste and a milky appearance to water. Maximum limit recommended for drinking water is 0.05 mg/l.[1]
Calcium (Ca) and magnesium (Mg)	Dissolved from practically all rocks and soils, especially from limestone, dolomite, and gypsum.	Cause of most of the hardness, and in combination with bicarbonate is the cause of scale formation in steam boilers, water heaters, and pipes (see hardness). Water low in calcium and magnesium is desired in electroplating, tanning, dyeing, and in textile manufacturing.
Sodium (Na) and potassium (K)	Dissolved from practically all rocks and soils. Sewage and industrial wastes are also major sources.	Concentrations of less than 50 mg/l have little effect on the usefulness of water for most purposes. More than 50 mg/l may cause foaming in steam boilers.

Bicarbonate (HCO_3) and carbonate (CO_3)	The bicarbonate ion may result from atmospheric carbon dioxide and the solution of carbon dioxide produced during the decomposition of organic matter in the soil. The major source, however, is from the solution of limestone.	Bicarbonate and carbonate produce alkalinity. Bicarbonates of calcium and magnesium decompose in steam boilers and hot-water facilities to form scale and release corrosive carbon dioxide gas (see hardness).
Sulfate (SO_4)	Dissolved from rocks and soils containing gypsum, iron sulfides, and other sulfur compounds. Commonly present in some industrial wastes and sewage.	Sulfates in water containing calcium may form hard calcium sulfate scale in steam boilers. The maximum limit recommended for drinking water is 250 mg/l.[1]
Chloride (Cl)	Dissolved from rocks and soils in small quantities. Relatively large amounts are derived from sewage, industrial wastes, and highway salting practices.	In large quantities chloride increases the corrosiveness of water. Large amounts in combination with sodium will give a salty taste. Maximum limit recommended for drinking water is 250 mg/l.[1]
Fluoride (F)	Dissolved in small to minute quantities from most rocks and soils.	About 1.0 mg/l of fluoride in drinking water is believed to be helpful in reducing the incidence of tooth decay in small children; larger concentrations cause mottling of enamel. It is recommended that fluoride not exceed 1.7 mg/l where the 5-year average of daily maximum air temperature is 53.0 to 53.7°F.[1]
Nitrate (NO_3)	Decaying organic matter, sewage, and fertilizers are principal sources.	Small concentrations have no effect on usefulness of water. Most ground waters contain less than 10 mg/l. Waters containing more than 45 mg/l may cause methoglobinemia (a disease often fatal in infants) and, therefore, should not be used in infant feeding. Maximum limit recommended for drinking water is 45 mg/l.[1]
Phosphate (PO_4)	Dissolved in very small quantities from most rocks and soils. The chief sources are fertilizer and detergents.	Concentrations much greater than local averages may indicate contamination from phosphate detergents and/or fertilizers.

Table 12. *Continued*

Constituent or property	Source or cause	Significance
Hardness (as $CaCO_3$)	In most waters nearly all the hardness is due to calcium and magnesium. All of the metallic cations other than the alkali metals also cause hardness. There are two classes of hardness—carbonate (temporary) and noncarbonate (permanent). Carbonate hardness refers to the hardness resulting from cations in association with carbonate and bicarbonate; it is called temporary because it may be removed by boiling the water. Noncarbonate hardness refers to that resulting from cations in association with other anions.	Hardness consumes soap before a lather will form and deposits soap curds on bathtubs. Carbonate hardness is the cause of scale formation in boilers, water heaters, radiators, and pipes, causing a decrease in heat transfer and restricted flow of water. Waters of hardness up to 60 mg/l are considered soft; 61 to 120 mg/l, moderately hard; 121 to 180 mg/l, hard; more than 180 mg/l, very hard. Milligrams per liter divided by 17.1 yields the concentration in grains per gallon.
Dissolved solids—A measure of all the chemical constituents dissolved in a particular water. The maximum limit recommended for drinking water is 500 mg/l, but water containing up to 1,000 mg/l may be used where less mineralized supplies are not available.[1]		
Specific conductance (micromhos at 25°C)—A measure of the capacity of a water to conduct an electrical current. It varies with concentration and degree of ionization of the constituents. May be used to obtain a rapid estimate of the approximate dissolved-solids content of water. The sum of dissolved-solids concentration for ground water in the study area is approximately equal to 0.55 times the specific conductance.		
pH—The negative logarithm of the hydrogen-ion concentration. A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote alkaline solutions; values lower than 7.0 indicate acidic solutions. Corrosiveness of water generally increases with decreasing pH. The pH of most natural waters ranges between 6 and 8.		
Temperature—The temperature of ground water that occurs between the water table and about 60 feet below the water table is approximately the same as the average annual air temperature (Lovering and Goode, 1963, p. 5); below this point, ground-water temperatures increase with depth about 1°F for each 50 to 100 feet.		

[1] U.S. Public Health Service (1962), *Drinking Water Standards.*

Table 13. Field Determinations of the Specific Conductance, Hardness, and pH of Water from the Major Aquifers in the Area

Aquifer	Specific conductance in micromhos at 25°C			Total hardness[1] in grains per gallon			pH		
	N[2]	R[3]	M[4]	N	R	M	N	R	M
				CARBONATE ROCKS					
Conestoga Formation	50	325–940	500	53	6–24	13	20	6.8–7.8	7.0
Limestones of the Kinzers Formation	22	250–1150	525	22	6–20	12	17	6.5–7.5	7.2
Ledger Formation	11	260–1500	650	11	7–19	16	11	7.0–8.0	7.0
Vintage Formation	15	295–750	410	15	7–16	11	14	6.0–8.0	7.0
MEDIAN FOR CARBONATE ROCKS			513			12.5			7.0
				NONCARBONATE ROCKS					
Antietam Formation	18	70–430	185	17	1–8	3	15	5.5–6.5	5.8
Chickies Formation	29	10–420	80	29	1–6	2	20	5.0–6.6	5.5
Harpers Formation	57	35–600	220	54	1–15	5	31	5.3–7.5	6.0
Shale of the Kinzers Formation	7	120–420	330	8	3–12	7	4	5.5–6.9	6.6
Marburg Schist	72	20–430	130	71	1–11	3	45	5.0–7.8	6.0
Peach Bottom Slate	6	50–130	70	4	1–3	1.5	4	5.3–6.2	6.0
Peters Creek Schist	12	50–265	117	13	1–6	2	10	5.2–6.8	5.7
Wissahickon Formation	115	25–560	125	92	1–10	2	48	5.0–7.0	5.9
MEDIAN FOR NON-CARBONATE ROCKS			128			2.5			5.9

[1] Hardness in grains per gallon multiplied by 17.1 gives approximate hardness in milligrams per liter.
[2] N = number of samples
[3] R = range of values
[4] M = median value

Kinzers Formation yielded water that had a median specific conductance more than 185 micromhos. The median specific conductance for the carbonates (513 micromhos) is about 4 times as large as that for the noncarbonates (128 micromhos) (see Table 13).

The general areal distribution of field specific conductance measured during the investigation is shown in Figure 8. The zones containing water of high specific conductance (401 to 750 micromhos) correspond very closely to those areas underlain by carbonate rocks, and the zones containing water of low specific conductance (0 to 400 micromhos) correspond very closely to those areas underlain by noncarbonate rocks. Most of the isolated zones containing water having a specific conductance greater than 750 micromhos in the noncarbonate rocks of the Marburg, Wissahickon, Peters Creek, and Peach Bottom probably are zones in which local contamination of the ground water has occurred.

Total hardness ranged from 1 to 24 gpg (grains per gallon) (17 to 410 mg/l). The median hardness of water from each noncarbonate-rock aquifer was 7 gpg (120 mg/l) or less. Of all the noncarbonate-rock aquifers, only the Harpers Formation and the shale of the Kinzers Formation had water with a median hardness of more than 3 gpg (50 mg/l). Water from each carbonate-rock aquifer had a median hardness of 11 gpg (190 mg/l) or more. Generally water from the carbonate rocks is about 5 times as hard as the water from the noncarbonates (see Table 13).

The pH of ground water in the area ranged from 5.0 to 8.0. The most acidic water was found in the Chickies Formation, where the median pH was 5.5. The shale of the Kinzers Formation was the only noncarbonate-rock aquifer that had water with a median pH of more than 6.0. All the carbonate-rock aquifers had water with a median pH of 7.0 or above (see Table 13).

In general, soft, acidic water with low specific conductance is associated with the noncarbonate rocks, and hard, neutral to slightly alkaline water with high specific conductance is associated with the carbonate rocks. These data indicate that the largest amounts of rock material are dissolved from the more soluble carbonate aquifers. This solution activity enlarges the fracture openings and gives the carbonate aquifers the greatest potential for development of high-yield wells in the area.

Temperature

The median of 341 temperature measurements of water from wells in the area is about 13°C (Celsius). Generally temperatures ranged from about 11°C (sometime during the months of December through March) to about 14°C (sometime during the months of July through October).

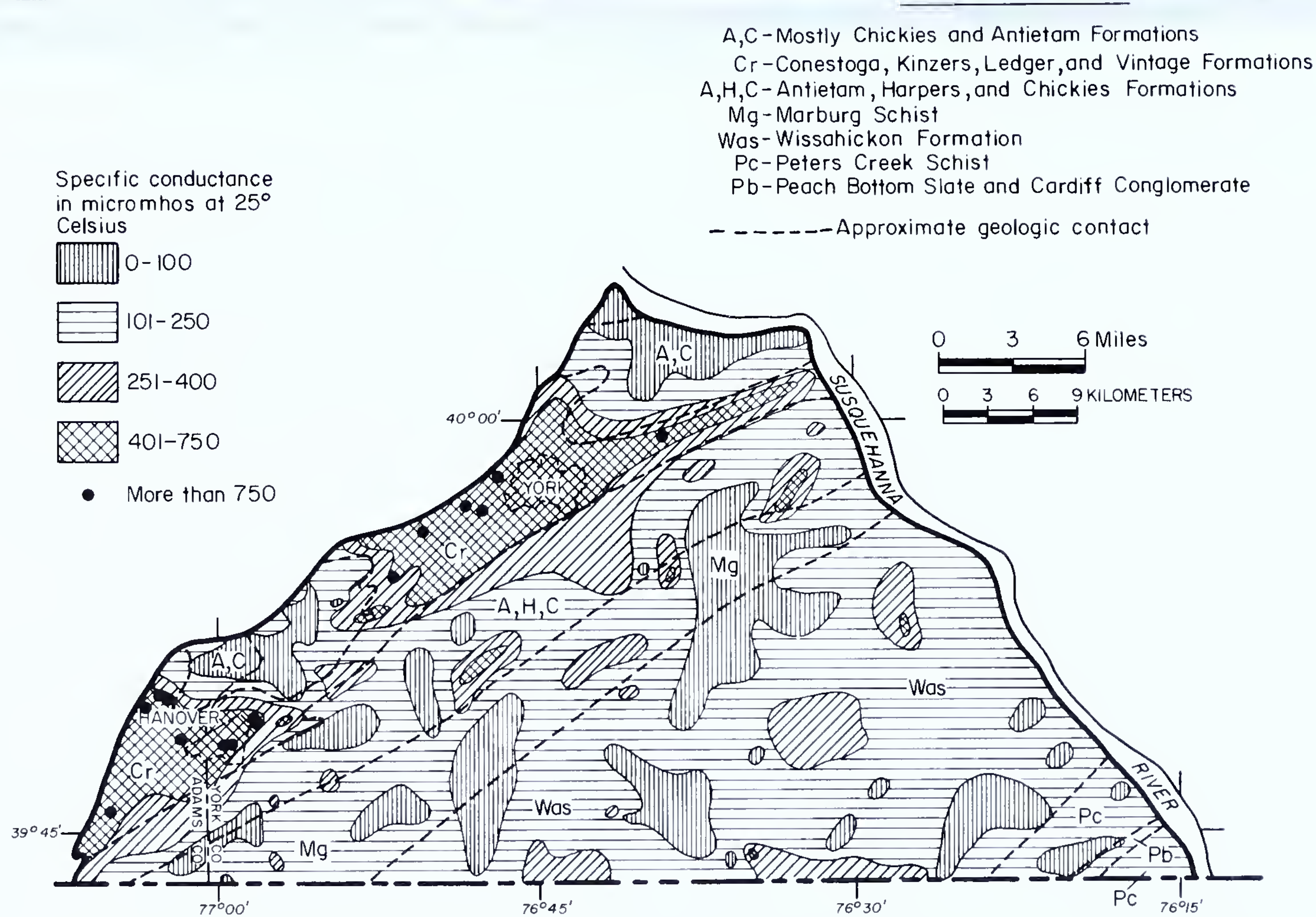


Figure 8. Map showing areal distribution of specific conductance in central and southern York County and southeastern Adams County.

The seasonal range in the temperature of water from wells is generally much less than the seasonal range in the temperature of surface water in the area.

Chemical Analyses

The results of 92 chemical analyses made on water samples from 88 wells in the study area are given in Table 18. The median concentrations of dissolved constituents in the ground water and the water types (both prepared from data in Table 18) are listed by aquifer in Table 14. The water type was determined from the dominant concentrations of anions and cations, expressed in milliequivalents per liter (me/l).

In general, the highest concentrations of iron and manganese are found in water from the noncarbonate aquifers, whereas the highest concentrations of calcium, magnesium, sodium, bicarbonate, sulfate, chloride, and phosphate are found in water from the carbonate aquifers. Concentrations of silica, potassium, nitrate, and fluoride are about the same regardless of rock type. Twenty water samples were picked at random and were analyzed for some of the heavy metals that may be harmful to health or impart undesirable qualities to water even in low concentrations (see Table 12). The metals selected for analysis were cadmium, chromium, copper, lead, nickel, and zinc. Of these elements cadmium was the only one undetected; where the others were present, none exceeded the limits recommended by the U. S. Public Health Service (1962) (see Table 15).

The water from most of the aquifers is calcium bicarbonate in type. However, because of the dilute nature of the water in the noncarbonate rocks nitrate is a significant part (greater than 24 percent) of the anion composition in water from the Wissahickon Formation, Marburg Schist, Peach Bottom Slate, and Peters Creek Schist. Chloride and sulfate constitute a significant part (greater than 42 and 38 percent, respectively) of the anion composition in water from the Harpers Formation and the quartzite units of the Chickies Formation (see Table 14). These concentrations of nitrate, chloride, and sulfate are unnatural for the area and are derived mostly from contamination by crop fertilizers, road salts, on-lot sewage disposal, and barnyard wastes.

Water-Quality Problems

Common ground-water-quality problems in the area include hard water, acid water, and high concentrations of iron, manganese, and nitrate. Table 15 shows the percent of water samples by aquifer that were hard (7 to 10 gpg (120 to 170 mg/l) hardness), very hard (more than

Table 14. *Chemical Type and Median Concentration of Dissolved Constituents in the Ground Water from the Aquifers*

(Concentrations in milligrams per liter)

Aquifer	Dominant rock type	Silica (SiO_2)	Total iron (Fe)	Total manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Phosphate (PO_4)	Type of water
CARBONATE ROCKS															
Conestoga Formation	Limestone	10	0.16	0.01	90	9.7	6.4	2.5	170	38	12	33	0.1	0.05	Calcium bicarbonate
Kinzers Formation	do.	12	.04	.005	85	23	23	2.8	278	36.5	41.5	18	.05	.13	Calcium bicarbonate
Ledger Formation	Dolomite	8.5	.50	.01	74	26	8.4	1.3	259	54	20	1.3	.05	.005	Calcium bicarbonate
Vintage Formation	do.	8.9	.15	.01	69	15	18	1.3	236	32	63	17	.1	.1	Calcium bicarbonate
Wakefield Marble[1]	Marble	7.8	.15	.02	57	6.0	4.3	1.6	119	13	14	47	.1	.04	Calcium bicarbonate
MEDIAN FOR CARBONATE ROCKS		8.9	.15	.01	71	15	8.4	1.6	236	37	20	18	.1	.05	Calcium bicarbonate
NONCARBONATE ROCKS															
Antietam Formation	Quartzite	14	.02	.03	24	5.6	6.8	3.2	68	25	11	18	.1	.17	Calcium bicarbonate
Chickies Formation	Quartzite and slate	8.6	.27	.01	5.5	3.1	3.4	1.1	9	8.6	2.7	4.9	.15	.00	Calcium magnesium sulfate bicarbonate
Harpers Formation	Phyllite	14	.07	.05	22	7.9	11	1.6	21	8.5	20	10.8	.1	.02	Calcium magnesium chloride bicarbonate
Kinzers Formation[1]	Shale	12	.10	.01	59	6.6	5.0	3.2	178	27	6.0	16	.3	.17	Calcium bicarbonate
Marburg Schist	Schist	8.2	1.1	.02	10.4	3.9	3.85	.85	22	6.4	5.85	13	.0	.00	Calcium bicarbonate nitrate
Peach Bottom Slate[2]	Slate	6.2	.40	.045	5.4	2.0	4.0	.7	11	1.1	5.6	21	.05	.1	Calcium sodium nitrate bicarbonate
Peters Creek Schist	Schist	7.2	2.0	.025	8.5	2.5	4.4	1.2	17	5.3	5.3	22	.0	.01	Calcium magnesium nitrate bicarbonate
Wissahickon Formation[3]	Schist	9.3	.08	.02	12	4.5	4.5	1.0	26	2.8	8.0	28	.0	.01	Calcium magnesium nitrate bicarbonate
MEDIAN FOR NONCARBONATE ROCKS		9	.33	.04	11	4.2	4.7	1.4	22	7.5	5.9	17	.1	.02	Calcium magnesium bicarbonate nitrate

[1] One sample.
[2] Two samples.
[3] Excluding Marburg Schist and including infolded metabasalt.

Table 15. *Percent of Water Samples, by Aquifer, that Indicate Water-Quality Problems*

Aquifer	Dominant rock type	Percent of water samples classified as indicated						
		Hard	Very hard	Acidic	Slightly acidic	High in total iron (Fe)	High in total manganese (Mn)	High in nitrate (NO_3)
		Field hardness 7 to 10 gpg[1]	Field hardness more than 10 gpg	Field pH less than 6.0	Field pH 6.0 to 6.9	More than 0.3 mg/l	More than 0.05 mg/l	More than 45 mg/l
CARBONATE ROCKS								
Conestoga Formation	Limestone	20	79	0	10	13	14	13
Kinzers Formation	do.	29	71	0	7	0	0	25
Ledger Formation	Dolomite	18	82	0	0	67	33	0
Vintage Formation	do.	42	53	0	21	33	33	0
NONCARBONATE ROCKS								
Antietam Formation	Quartzite	13	0	53	47	20	20	0
Chickies Formation	Quartzite and slate	0	0	70	30	37	37	0
Harpers Formation	Phyllite	24	4	16	69	13	50	13
Kinzers Formation	Shale	29	14	33	66	0	0	0
Marburg Schist	Schist	4	1	43	52	33	44	14
Peach Bottom Slate	Slate	0	0	25	75	50	100	0
Peters Creek Schist	Schist	0	0	66	33	75	25	20
Wissahickon Formation[2]	Schist and metabasalt	4	0	66	32	17	25	15

[1] Grains per gallon (gpg) multiplied by 17.1 converts concentrations to milligrams per liter.
[2] Excluding Marburg Schist.

10 gpg (170 mg/l) hardness), acidic (pH less than 6.0), slightly acidic (pH 6.0 to 6.9), high in iron (more than 0.3 mg/l), high in manganese (more than 0.05 mg/l), and high in nitrate (more than 45 mg/l).

The most severe hardness problems are associated with water from the carbonate-rock aquifers. Nearly 100 percent of all the samples from wells in the carbonate aquifers were hard or very hard water. The Antietam and Harpers Formations and the shale of the Kinzers Formation were the only aquifers of all the noncarbonates that had more than 10 percent of the samples classified as hard or very hard.

Acidic ground water was encountered mostly from wells in the noncarbonate-rock aquifers (Table 15), where about 97 percent of the samples had a pH less than 7.0. Over half of the samples from the Antietam and two thirds or more of the samples from the Chickies, Wissahickon, and Peters Creek had a pH less than 6.0.

Excessive concentrations of iron (more than 0.3 mg/l) were found in 24 of the 85 samples that were analyzed for this constituent (Table 18). Excessive iron concentrations were found in 75 percent of the samples from the Peters Creek Schist, 67 percent of the samples from the Ledger Formation, and 50 percent of the samples from the Peach Bottom Slate. About one third of the samples from the other aquifers had iron concentrations that exceeded 0.3 mg/l. None of the samples from the Kinzers Formation contained iron concentrations greater than 0.3 mg/l.

Manganese concentrations exceeded 0.05 mg/l in 23 of 83 samples analyzed for this constituent. Excessive manganese was found in all of the samples from the Peach Bottom Slate, 50 percent of the samples from the Harpers Formation, and 44 percent of the samples from the Marburg Schist. Fourteen to 37 percent of the samples from the Antietam, Chickies, Conestoga, Ledger, Peters Creek, Vintage, and Wissahickon contained manganese concentrations greater than 0.05 mg/l. None of the water sampled from the Kinzers Formation contained excessive manganese.

About 12 percent of the samples (11 of 92) from the study area had nitrate concentrations that exceeded 45 mg/l (see Table 18). These excessive nitrate concentrations were found in 13 to 25 percent of the samples from the Conestoga, Harpers, Peters Creek, Wissahickon, Marburg, and the limestones of the Kinzers (Table 15). Samples from the other aquifers listed in Table 15 did not contain excessive nitrate. Three samples from the Wissahickon Formation had nitrate concentrations of about 90 mg/l and one sample from the limestones of the Kinzers had a nitrate concentration of 154 mg/l.

Ground-water-quality problems such as hard water, acidic water, and high concentrations of iron and manganese are generally caused by

Table 16. *Concentration of Dissolved Constituents in Water from Well Yo-596*

	(Concentrations in milligrams per liter)											
Date	SiO_2	Ca	Mg	Na	K	HCO_3	SO_4	Cl	NO_3	F	PO_4	Sum of dissolved constituents
3/11/69	6.2	14	6.0	5.2	16	24	14	16	44	0	1.0	133
10/30/69	5.8	3.8	2.9	2.6	6.4	10	2.2	6.7	26	0	.00	59
7/15/70	6.5	13	6.0	4.5	7.8	18	7.1	17	43	0	—	114
11/04/70	5.3	4.8	3.8	3.3	6.4	9	1.8	9.8	25	0	0	65

natural conditions of the ground water and the ground-water reservoir in the area. There is no natural source for the high concentrations of nitrate in the area, and wherever high nitrate concentrations exist contamination of the ground water is indicated.

Changes in Ground-Water Quality

Changes in the specific conductance, and therefore in the concentration of dissolved solids, occurred from month to month in ground water from the bedrock and regolith.

Table 16 shows the concentration of dissolved constituents, in milligrams per liter, in water from well Yo-596 (one of the 13 shallow wells listed above) for March 11, 1969, October 30, 1969, July 15, 1970, and November 4, 1970.

These data indicate that the concentrations of most of the dissolved constituents found in ground water can fluctuate substantially with time. The exact mechanism for each increase and decrease in the dissolved constituents remains to be determined, but the fluctuations are mostly controlled by the dissolving and flushing of the available soluble minerals from the unsaturated part of the regolith by infiltrating recharge water (Growitz and Lloyd, 1971).

Such changes in ground-water quality can significantly affect the usefulness of the water, particularly where dissolved constituents that may be harmful to health are near critical concentrations. For example, the analyses for water from well Yo-596 (see Table 16) indicate that water having nitrate concentrations of about 30 mg/l at the time of sampling might periodically have nitrate concentrations greater than 45 mg/l. About 35 percent of the wells listed in Table 18 had water with nitrate concentrations of about 30 mg/l; thus, it is possible that excessive nitrate concentrations may occur periodically in water from these wells.

In addition to quality changes that occur with time, the specific conductance of ground water (thus, the concentrations of dissolved solids) is higher in the Wissahickon bedrock than it is in the Wissahickon regolith. Water in the bedrock contains more dissolved solids because, in general, it has traveled greater distances and for longer periods of time and, consequently, it has dissolved more ground-water-reservoir material than water in the regolith. The following table shows that water from the deeper bedrock wells throughout the study area generally contains more dissolved mineral matter than water from the shallower bedrock wells.

	Depth of wells below land surface[2]	
	100–200 feet	Greater than 200 feet
Median sum of dissolved constituents[1]	107 mg/l	148 mg/l
Number of analyses	31	13

[1] Data from Table 18
[2] Data from Table 17

CONCLUSIONS

Under normal weather conditions, the study area receives about 41 inches (104 cm) of precipitation each year. About 14 inches (36 cm) of this precipitation sustains streamflow, and the remainder is consumed by evapotranspiration. During dry years (when precipitation is about 6 inches (15 cm) below normal) streamflow may be as little as 8 inches (20 cm), and during wet years (when precipitation is about 6 inches (15 cm) above normal) it may be as much as 20 inches (51 cm).

Sixty-five to 70 percent of streamflow from the area has been routed through and discharged from the ground-water reservoir. Thus, contamination of the ground water or the ground-water reservoir would destroy the good quality of most surface-water supplies.

The ground water in the area occurs in and moves through the pore spaces in the regolith and the fractures and solution openings in the underlying bedrock. In general, the regolith has larger storage capacity per unit volume but poorer water-transmitting ability than the bedrock. Most wells tap the bedrock directly for ground-water supplies. Water in the regolith moves downward to recharge the bedrock and sustain streamflow.

The major bedrock aquifers in the area are the Conestoga, Kinzers, Ledger, and Vintage Formations (chiefly carbonate rocks), and the Antietam, Chickies, and Harpers Formations, the albite-chlorite schist and metavolcanics of the Wissahickon Formation, the Marburg Schist, the Peters Creek Schist, and the Peach Bottom Slate (noncarbonate rocks).

The specific capacities of wells in the aquifers are directly related to, and are a relative measure of, ground-water availability or the ability of the rocks to store water and transmit water to wells.

The specific capacities of wells in the area are primarily influenced by rock type, topography, depth to and yield of water-bearing zones, and rate and duration of pumping. The 1-hour specific capacities of 90 percent of the wells in the carbonate rocks range from less than 0.04 to 40 gpm/ft (0.008 to 8.3 (l/s)/m) and the median is 0.90 gpm/ft (0.19 (l/s)/m). The

1-hour specific capacities of 90 percent of the wells in the noncarbonate rocks range from about 0.04 to 6.3 gpm/ft (0.008 to 1.3 (l/s)/m) and the median is 0.48 gpm/ft (0.10 (l/s)/m). The median specific capacities are: 0.88 gpm/ft (0.18 (l/s)/m) for wells in valleys, 0.64 gpm/ft (0.13 (l/s)/m) for wells in draws, 0.49 gpm/ft (0.10 (l/s)/m) for wells on slopes, and 0.45 gpm/ft (0.09 (l/s)/m) for wells on hilltops. Most water-bearing zones occur in the first 250 feet (75 m) below land surface. However, major water-bearing zones have been reported to occur as deep as 400 feet (120 m) below land surface in the albite-chlorite schist and metavolcanics of the Wissahickon Formation. Doubling the average pumping rate in selected wells reduced the average specific capacity of the wells by 30 percent. On the average, specific capacities are reduced by about 50 percent when pumping time is increased from 1 to 24 hours.

Assuming 24-hour pumping and 50 feet (15 m) of available drawdown, one of every four wells located and constructed for large yields will produce 400 gpm (25 l/s) from the Ledger, 140 gpm (8.8 l/s) from the Conestoga, 80 gpm (5 l/s) from the Vintage, about 15 gpm (0.95 l/s) from the Harpers and Marburg and the limestones of the Kinzers, and about 10 gpm (0.63 l/s) from the Antietam.

The specific conductance of the ground water ranges from less than 50 to 1,500 micromhos. The median specific conductance is about 500 micromhos for water from the carbonate-rock aquifers and about 130 micromhos for water from the noncarbonate-rock aquifers.

Total hardness of the ground water ranges from 1 to 24 gpg (17 to 410 mg/l). The average hardness of water from the carbonate rocks is about 13 gpg (220 mg/l) (very hard) whereas that from the noncarbonate rocks is 3 gpg (50 mg/l) (soft).

The pH of the ground water ranges from 5.0 to 8.0. Water from the carbonate rock aquifers has an average pH of about 7.0 (neutral), and water from the noncarbonate-rock aquifers has an average pH of about 5.9 (acidic).

There are no serious widespread ground-water-quality problems in the area. However, nitrate concentrations ranged from about 30 to 45 mg/l (indicating contamination of the ground water) in about 35 percent of all the ground-water samples analyzed for nitrate. High nitrate concentrations were most prevalent in water from wells in the Conestoga and Wissahickon Formations. The concentration of dissolved constituents in ground water from several wells in the Wissahickon Formation was found to fluctuate with time. Such ground-water-quality changes probably occur in all the aquifers throughout the study area. In addition, the concentration of dissolved constituents in ground water from the area generally increases with increasing depth below land surface.

GLOSSARY

Anticline. A fold in rocks in which the strata dip outward away from the axis of the fold. Opposite from syncline.

Anticlinorium (Anticlinoria). A series of anticlines and synclines so arranged that together they form a very large gentle arch or anticline.

Aquifer. A formation, group of formations, or part of a formation from which water is collectable in usable quantities.

Base streamflow. The discharge entering stream channels from the ground-water reservoir.

Bedding. Layers of sedimentary rocks of the same or different lithology.

Bedrock. A general term for the rock, usually solid, that underlies soil or other unconsolidated or semiconsolidated surficial material.

Carbonate rock. Rock composed primarily of minerals that contain the radical CO_3. In the study area the rocks are limestone, $CaCO_3$, and dolomite, $CaMg(CO_3)_2$.

Cubic feet per second (cfs). A unit expressing rates of discharge.

Cubic feet per second per square mile (cfsm). The number of cubic feet of water flowing from each square mile of area drained by a stream during each second, assuming that the runoff is distributed uniformly in time and area.

Cleavage. Breaks or splits in rock along definite, parallel, closely spaced planes; may be highly inclined to the bedding planes.

Deformation. Any change in the original form or volume of rock masses produced by earth forces; folding, faulting, and solid flow are common modes of deformation.

Dip. The angle at which a bed or any planar feature is inclined from the horizontal.

Drainage density. Ratio of total length of all channels within a drainage basin to the area of that basin.

Drainage pattern. Arrangement of natural drainage lines within an area; patterns are related to local geology and geologic history.

Fault. A surface or zone of fracture in rock along which movement has taken place.

Fracture. A general term for any break in rock due to mechanical failure by stress, including cracks, joints, and faults.

Gravity drainage. The release of water from a porous and permeable material due to the force of gravity.

Ground water. That part of the subsurface water in the zone of saturation.

Ground-water discharge. Release of ground water in springs, seeps, or wells from the ground-water reservoir.

Ground-water recharge. Addition of water to the ground-water reservoir by infiltrating precipitation or seepage from a streambed.

Ground-water reservoir. See aquifer.

Hydrograph. A graph showing stage, flow velocity, or other properties of water with respect to time.

Joints. Fractures in rock, generally more or less vertical or transverse to bedding, along which no appreciable movement has occurred.

Lithology. A term used to mean the description of rocks. Also, loosely, the composition and texture of rock.

Lost circulation. Refers to the movement of rock cuttings and drilling fluid back into the rock through subsurface opening(s) rather than out of the borehole at the surface, during a rotary well drilling operation.

Observation well. A well in which periodic measurements of water level or water quality are made.

Overthrust. A thrust fault with a low dip and a large amount of movement, generally measured in miles.

Permeability. The capacity of a porous rock, sediment or soil to transmit a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

Porosity. The ratio of the aggregate volume of interstices in a rock or soil to its total volume. It is usually stated as a percentage.

Precipitation gage. An instrument that measures rainfall or snowfall in rainfall-equivalent inches.

Recumbent folds. Folds in rocks that have axial planes that are more or less horizontal.

Regolith. The unconsolidated to semiconsolidated residual mantle of weathered rock material, including the soil profile, that lies between land surface and the unweathered bedrock.

Reported well yield. The short-term yield of a well as reported by well drillers.

Saturated zone. That part of the water-bearing material in which all voids are completely filled with water under pressure equal to or greater than atmospheric.

Schistosity. Laminated structure that occurs in metamorphic rocks. Generally the result of the parallel arrangement of platy and ellipsoidal mineral grains.

Solution cavity. Any void, generally an enlargement in a fracture opening, caused by solution activity in limestone or dolomite.

Specific yield. The ratio of (1) the volume of water which the rock or soil, after being saturated, will yield by complete gravity drainage to (2) the volume of rock or soil. In the natural environment, specific yield is only an approximate measure of the storage capacity of an aquifer because gravity drainage is never complete.

Standard complete chemical analysis. The routine laboratory analysis generally made for the following substances or properties: bicarbonate,

calcium, chloride, iron, magnesium, manganese, nitrate, phosphate, potassium, silica, sulfate, total dissolved solids, hardness, specific conductance, and pH.

Static water level. The water level in a well when the well is not being pumped and when the water level is unaffected by any prior pumping of the well.

Storage coefficient. The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head.

Stream gage. An instrument that measures the stage or water level of a stream. Using a rating curve, these stream water levels can be converted into corresponding streamflow.

Strike. The bearing or trend of the outcrop of an inclined bed or structure measured in a horizontal plane.

Structure. The sum of the structural features (features produced in the rock by movements after deposition, and commonly after consolidation, of the rock) in an area.

Surface water. That water on the surface of the earth. Surface water is generally a combination of overland runoff and ground-water discharge, the proportions varying from almost 100 percent overland runoff during periods of high-intensity rain to 100 percent ground-water discharge during periods of little or no rain.

Syncline. A fold in the rocks in which the strata dip inward toward the axis. Opposite from anticline.

Thiessen net geometry. A geometric system of dividing an area into polygons whose centers are points of observation or data collection (such as precipitation stations or observation wells). The polygons are constructed by joining the points of observation by lines dividing the area into a network of triangles whose sides are as short as possible. At the midpoint of each triangle side, lines perpendicular to the sides are constructed and extended to intersect each other. The intersecting perpendiculars define the polygons of influence for each point of observation. The areas of the polygons are determined with a planimeter.

Thrust fault. A fault in which the hanging wall has moved upward relative to the foot wall, with a low angle of inclination relative to a horizontal plane.

Thrusting. See overthrust. The dynamic process by which thrust faults occur.

Trace metals. Those ions that generally make up an insignificant part of any water sample.

Transmissibility, coefficient of. The rate of flow of water, at the prevailing water temperature, in gallons per day, through a vertical strip

of the aquifer 1 foot wide extending the full saturated height of the aquifer under a hydraulic gradient of 100 percent. This term is not currently used; it has been replaced by transmissivity.

Transmissivity. The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient.

Unconformable. Having the relationship of unconformity to the underlying rocks; not succeeding the underlying strata in immediate order of age.

Water table. That surface in an unconfined ground-water body at which the pressure is atmospheric.

Zone of water-level fluctuation. The range between highest and lowest water level for any given time period.

CONVERSION FACTORS

Factors for converting English units to metric units are shown to four significant figures. However, in the text the metric equivalents are shown only to the number of significant figures consistent with the value for the English units.

English	*Multiply by*	*Metric*
in. (inches)	2.540	cm (centimeters)
ft (feet)	3.048×10^{-1}	m (meters)
mi (miles)	1.609	km (kilometers)
mi^2 (square miles)	2.590	km^2 (square kilometers)
bg (billion gallons)	3.785×10^{6}	kl (kiloliters)
gpm (gallons per minute)	6.308×10^{-2}	l/s (liters per second)
gpd (gallons per day)	3.785	l/d (liters per day)
mgd (million gallons per day)	3.785×10^{3}	kl/d (kiloliters per day)
gpm/ft (gallons per minute per foot)	2.069×10^{-1}	(l/s)/m (liters per second per meter)
gpd/ft (gallons per day per foot)	1.242×10^{1}	(l/d)/m (liters per day per meter)
ft^2/d (feet squared per day)	9.293×10^{-2}	m^2/d (meters squared per day)
gpg (grains per gallon)	1.710×10^{1}	mg/l (milligrams per liter)

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TABLE 17. RECORD OF WELLS

Well location: The number is that assigned to identify the well. It is prefixed by a two-letter abbreviation of the county. The lat-long is the coordinates in degrees and minutes of the southeast corner of a 1-minute quadrangle within which the well is located.

Use: C, commercial; D, dewatering; H, domestic; I, irrigation, N, industrial; P, public supply; R, recreation; S, stock supply; T, institutional; U, unused; W, recharge.

Topographic setting: D, local depression; H, hilltop; S, slope; V, valley; W, draw.

Aquifer: Ꞓa, Antietam Formation; Ꞓc, Chickies Formation; Oc, Conestoga Formation; Ꞓhp, Harpers Formation; Ꞓk, Kinzers Formation; Ꞓl, Ledger Formation; mg, Marburg schist; mb, metabasalt; mbw, metabasalt in the Wissahickon Formation; pb, Peach Bottom slate; pc, Peters Creek schist; Ꞓv, Vintage Formation; wm, Wakefield marble; was, Wissahickon Formation.

Lithology: cong, conglomerate; dol, dolomite; ign, igneous rock; ls, limestone; metc, coarse-grained metamorphic rock; metf, fine-grained metamorphic rock; sh, shale; shls, shaly limestone; sch, schist.

Static water level: Date measured, month/last two digits of year.

Pumping data: gpm, gallons per minute. Pumping periods less than 1 hour as follows: A, 1-15 minutes; B, 16-30 minutes; C, 31-45 minutes; D, 46-59 minutes.

Hardness: gpg, grains per gallon.

TABLE 17.

Well location								Aquifer	
Number	Lat-Long	Owner	Oriller	Oate completed	Use	Alti- tude of land surface (feet)	Topo- graphic setting	Name	Compo- sition
									AOAM5
Ad- 180	3950-7700	William Hardy	Harrisburg's Kohl 8ros.	1966	H	625	5	Ꞓk	---
181	3950-7700	Charles Huff	Mummert & 5terner	1967	H	705	H	Ꞓc	---
182	3951-7700	Maurice Myers	---	1930	H	580	5	Ꞓa	---
183	3951-7700	do.	Harrisburg's Kohl Bros.	1961	H	585	5	Ꞓa	---
185	3950-7700	Harry Jacoby	do.	1964	H	560	5	Ꞓk	ls
1B6	3950-7700	do.	do.	1964	U	560	5	Ꞓk	ls
187	3950-7701	Vance Schuler	---	1965	H	535	5	Ꞓl	dol
188	3949-7702	Bethlehem 5teel Corp.	---	---	H	510	5	Ꞓk	ls
189	3949-7702	Jesuit Farms	William W. Reichart	1959	H	518	5	Ꞓk	ls
190	3948-7702	Claude Murren	---	---	H	542	5	0c	ls
191	3947-7704	O. F. Bair	---	---	H	570	H	Ꞓk	ls
192	3947-7704	Martin Grove	Mummert & Sterner	1959	H	585	H	Ꞓk	ls
193	3946-7703	John Grove	do.	1965	H	545	5	0c	ls
194	3949-7701	8ethlehem 5teel Corp.	---	1960	H	542	H	Ꞓv	dol
195	3948-7700	J. R. Hagarman	---	---	U	545	H	0c	ls
196	3947-7702	E. R. Miller	---	---	H	555	S	0c	ls
197	3947-7702	Francis Murren	---	---	H	565	S	0c	ls
19B	3945-7701	Hanover 5hoe Farms	A. C. Reider & 5on, Inc.	1952	H	625	5	Ꞓhp	---
199	3946-7702	do.	William W. Reichart	---	H	565	H	0c	ls
200	3945-7705	8or. of Littlestown	Harrisburg's Kohl 8ros.	1965	U	575	5	0c	ls
201	3944-7704	do.	---	1941	P	610	H	0c	ls
202	3944-7704	do.	---	1941	P	610	H	0c	ls
203	3944-7704	do.	---	---	P	605	5	0c	ls
204	3944-7704	do.	---	1915	P	600	5	0c	ls
205	3944-7704	do.	---	1940	P	600	5	0c	ls
206	3944-7704	do.	---	1932	U	600	5	0c	ls
207	3944-7704	do.	---	1941	P	640	5	Ꞓhp	---
208	3944-7706	do.	Harrisburg's Kohl Bros.	1967	P	618	S	0c	ls
209	3944-7706	do.	do.	1967	P	600	5	0c	ls
210	3944-7704	do.	do.	1967	U	620	H	Ꞓa	---
212	3943-7704	Mark Trostle	Weldo W. Funt	1964	H	705	H	Ꞓhp	---
213	3946-7702	Hanover Mun. Water Wks.	---	1931	P	545	V	0c	ls
214	3946-7702	do.	---	1931	P	545	V	0c	ls
215	3946-7702	do.	---	1931	P	542	V	0c	ls
216	3946-7701	do.	---	1931	P	542	V	0c	ls
217	3943-7705	Mike Bradley	---	1964	H	642	H	Ꞓhp	---
218	3934-7704	Elmer Outtera	William W. Reichart	1966	H	685	H	Ꞓhp	---
219	3944-7702	R. E. Hancock	do.	1960	H	710	5	Ꞓhp	---
220	3943-7702	F. R. Gourley	---	---	H	740	5	mg	sch
221	3944-7700	T. P. Ounchack	Mummert & 5terner	1969	H	780	H	mg	sch
222	3945-7702	Bessie Mathias	do.	1966	H	622	5	Ꞓhp	---
223	3944-7701	Eugene 5ines	---	---	H	682	5	Ꞓhp	---
224	3943-7701	Otto 5ells	Mummert & 5terner	1969	H	805	H	mg	sch
225	3943-7700	George Watt	do.	1969	H	775	H	mg	sch
226	3948-7700	Conewago Oairy	A. C. Reider	---	C	610	H	0c	ls
									YORK
Yo- 1	4002-7636	Marietta Gravity Water Co.	Paul E. Kohler	1948	U	695	W	Ꞓc	---
2	4002-7636	do.	Myers Bros. Orlg. Cont.	1954	P	465	5	Ꞓc	---
3	4002-7636	do.	do.	1954	P	520	5	Ꞓc	---
10	3954-7647	York New Salem 8or.	Young 8ros.	1955	P	600	5	Ꞓhp	---
11	3949-7646	AMP Inc.	Harrisburg's Kohl Bros.	1957	H	525	V	mg	sch
31	3958-7638	Campbell Chain Co.	A. C. Reider & 5on, Inc.	1966	N	418	5	0c	shls
42	3959-7638	do.	do.	1966	N	420	5	0c	shls
55	3959-763B	do.	do.	1966	U	395	5	0c	shls
60	3956-7650	Alvin Raybold	---	---	P	475	V	Ꞓl	dol
76	3957-7647	Medusa Portland Cement Co.	York Orilling Co., Inc.	1954	H	440	S	Ꞓk	ls
77	3958-7646	Ivan Lehr	A. C. Reider & 5on, Inc.	1952	P	405	V	Ꞓl	dol
79	3958-7646	Neal McGeehan	York Orilling Co., Inc.	1963	I	410	V	Ꞓl	dol
B8	4000-7639	York Co. Planning Comm.	A. C. Reider & Son, Inc.	1971	P	800	W	Ꞓc	---
95	3957-7644	5t. Regis Paper Co.	York Orilling Co., Inc.	1966	U	370	V	0c	shls
96	3957-7644	do.	do.	1966	U	360	V	0c	shls
192	3948-7659	Electric Light Plant	---	---	U	---	---	0c	ls
208	3957-7644	5t. Regis Paper Co.	---	---	U	355	V	0c	shls
209	3954-7640	G. A. 5tein	A. C. Reider & 5on, Inc.	---	H	820	5	Ꞓhp	sch
210	3954-7640	R. E. Fry	---	1950	H	780	H	Ꞓc	sch
211	3954-7639	R. F. Anderson, Jr.	A. C. Reider	1961	H	710	5	Ꞓhp	---
212	3954-7639	Gray Gembe	---	---	H	700	V	mg	sch
213	3954-7638	Robert Ryer	A. C. Reider	1957	H	750	5	mg	sch

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Pumping data			Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25° C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured	Yield (gpm)	Draw-down (feet)	Time (hrs)				
COUNTY												
130	91	6	60;125	18	8/66	20	115	---	---	---	---	Ad- 180
120	59	6	94	40	5/69	5	---	---	1	50	---	181
128	---	6	59	28	5/69	4	48	8	5	205	---	182
128	26	6	40;123	45	5/69	5	55	1	3	170	---	183
278	15	6	---	52	12/64	12	60	A	18	1000	7.2	185
300	18	6	---	16	5/69	4	153	1	19	1150	---	186
60	50	6	---	33	5/69	---	---	---	13	700	7.4	187
300	---	6	---	---	---	---	---	---	16	1000	7.2	188
424	15	6	---	27	5/69	10	151	1	9	510	---	189
30	30	48	---	22	5/69	5	---	---	7	325	---	190
30	30	48	---	23	5/69	2	---	---	11	590	---	191
261	20	6	---	48	5/69	5	33	A	15	525	7.4	192
200	18	6	---	31	5/69	6	112	1	16	560	7.5	193
310	30	6	---	36	5/69	5	83	8	16	560	7.4	194
24	24	48	---	19	5/69	---	---	---	17	790	7.5	195
19	19	48	---	13	5/69	5	---	---	16	690	7.8	196
38	38	48	---	30	5/69	---	---	---	9	360	---	197
170	---	6	---	14	5/69	10	50	A	6	260	---	198
160	---	6	---	25	5/69	8	62	1	12	425	---	199
400	41	6	70;280	8	10/65	43	242	24	12	---	---	200
350	---	8	---	---	---	40	---	---	20	700	---	201
400	---	8	---	---	---	60	---	---	20	725	7.0	202
193	---	8	---	---	---	9	---	---	17	550	7.0	203
335	100	8	---	25	8/69	14	150	999	---	---	---	204
340	---	8	---	25	---	30	---	---	13	480	7.7	205
200	---	8	---	---	---	---	---	---	---	---	---	206
510	---	8	---	---	---	17	---	---	9	400	---	207
474	40	6	---	20	8/69	12	5	1	12	430	8.0	208
400	59	6	68;170	6	12/67	63	240	24	12	400	7.8	209
400	30	6	108;150;170	30	6/67	3	---	---	---	---	---	210
75	12	6	35; 65	40	8/69	10	---	---	3	160	6.3	212
400	22	10	---	5	9/69	27	1	1	10	360	---	213
322	29	10	---	5	9/69	27	1	1	10	365	---	214
135	32	10	---	3	9/69	28	1	1	8	350	---	215
429	20	10	---	5	9/69	26	9	1	12	400	---	216
135	---	6	---	25	9/69	5	33	B	15	600	---	217
174	22	6	72;122;163	20	8/66	25	---	---	9	370	---	218
106	---	6	---	17	9/65	5	---	---	7	325	---	219
20	---	48	---	16	9/69	---	---	---	3	115	---	220
100	40	6	74	20	5/69	10	---	---	1	60	5.6	221
100	44	6	89	40	6/66	12	---	---	7	250	---	222
185	---	6	---	16	9/69	---	---	---	7	270	6.8	223
125	23	6	58; 65; 80	31	9/69	9	65	B	2	55	5.8	224
140	55	6	---	40	9/69	8	8	1	3	115	5.7	225
210	---	6	---	15	---	60	105	24	---	---	---	226
COUNTY												
115	---	8	---	16	4/48	100	84	24	---	---	---	Yo- 1
270	---	8	---	12	3/54	45	71	8	---	---	---	2
157	---	8	---	---	---	50	---	---	---	---	---	3
164	26	6	---	8	4/71	10	102	C	8	425	6.5	10
1028	28	6	---	16	8/57	1	500	2	---	---	---	11
300	73	6	77	20	11/66	110	55	27	15	650	7.5	31
59	53	6	---	30	6/71	80	28	24	14	625	7.5	42
293	21	6	---	16	6/71	5	---	---	---	---	---	55
---	---	6	---	25	6/71	10	140	C	18	1500	7.5	60
230	150	6	---	59	6/71	8	105	1	20	750	7.5	76
312	150	8	295	---	---	89	150	24	16	800	7.0	77
125	16	6	120	13	5/71	60	4	1	9	360	7.0	79
110	30	6	90	---	---	90	---	---	---	---	---	88
127	---	6	---	20	9/66	75	40	18	---	---	---	95
160	---	6	---	12	9/66	35	50	18	---	---	---	96
550	---	10	---	---	---	1	---	---	---	---	---	192
238	---	6	---	11	10/66	23	200	---	---	---	---	208
81	---	6	---	60	12/62	---	---	---	3	100	---	209
90	---	6	---	80	12/62	4	4	1	1	10	---	210
95	15	6	---	---	---	5	---	---	4	190	---	211
60	---	6	---	15	12/62	---	---	---	4	160	---	212
75	40	6	---	22	12/62	---	---	---	1	20	---	213

TABLE 17.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer	
Number	Lat-Long							Name	Composition
Yo- 214	3954-7638	Russell Fits	A. C. Reider	---	H	740	S	mg	sch
215	3954-7637	J. M. Austin	---	---	H	745	V	mg	sch
220	3947-7659	O. W. Westervelt Co.	---	1911	U	585	S	Oc	shls
221	3948-7643	Bruce Lambert	A. C. Reider	1914	U	630	V	was	sch
222	3948-7643	do.	do.	1932	U	630	V	was	sch
223	3948-7643	do.	do.	1945	U	630	V	was	sch
224	3947-7641	Glen Rock Bor.	---	---	P	810	V	was	sch
225	3948-7641	do.	A. C. Reider	---	U	695	V	mbw	gn
226	3944-7642	New Freedom Bor.	---	---	P	830	S	mbw	---
227	3944-7642	do.	---	1935	P	882	H	was	sch
228	3944-7642	do.	---	---	U	830	S	mbw	---
229	3944-7642	do.	A. C. Reider	1937	P	840	S	was	sch
230	3944-7641	do.	do.	1948	U	845	S	was	sch
231	3944-7641	do.	do.	1948	P	830	S	was	sch
232	3944-7642	do.	do.	1953	P	840	S	was	sch
233	3944-7642	do.	do.	1958	P	840	S	was	sch
234	3944-7642	do.	---	---	U	885	H	was	sch
235	3943-7619	Mr. Brown	---	---	U	450	V	pc	sch
236	3943-7619	C. P. Scarborough	---	---	U	420	V	pc	sch
237	3943-7619	Delta Bor.	A. C. Reider	1939	P	490	S	pb	sch
238	3943-7620	do.	do.	1957	P	450	S	pc	sch
239	3943-7619	do.	do.	1966	P	620	S	pb	sch
240	3943-7619	do.	---	---	U	620	S	pb	sch
241	3958-7640	Caterpillar Tractor Co.	Harrisburg's Kohl Bros.	1951	U	430	S	Oc	shls
242	3958-7641	do.	do.	1951	U	413	S	Єl	dol
243	3944-7641	New Freedom Bor.	---	---	U	830	V	was	sch
244	3949-7623	H. J. Reinecke	A. C. Reider	1966	H	605	S	was	sch
245	3948-7623	J. S. Caudill	---	---	H	615	S	was	sch
246	3946-7644	Susquehannock High Sch.	A. C. Reider & Son, Inc.	1971	U	780	H	mbw	gn
247	3947-7625	Miss Willison	---	---	H	305	V	was	sch
248	3943-7647	Vernon Masimore	A. C. Reider & Son, Inc.	1968	H	860	H	was	sch
249	3947-7649	do.	do.	1968	H	870	S	mg	sch
250	3947-7649	do.	do.	1968	H	868	S	mg	sch
251	3947-7649	do.	do.	1968	H	866	S	mg	sch
252	3947-7649	do.	do.	1968	H	863	S	mg	sch
253	3947-7649	do.	do.	1968	H	880	H	mg	sch
254	3947-7649	do.	do.	1968	H	885	H	mg	sch
255	3944-7621	Robert Ruff	---	1930	U	470	H	pc	metc
256	3944-7621	do.	---	1930	H	470	H	pc	metc
257	3945-7621	do.	---	---	U	465	H	was	sch
258	3944-7621	do.	---	1930	U	470	H	pc	metc
259	3953-7635	Earl Leiphart	A. C. Reider	1966	H	760	V	mg	sch
260	3946-7657	Walter Bange	Mummert & Sterner	1953	P	758	S	Єhp	sch
261	3944-7652	Clifford Parry	do.	1969	H	770	S	mg	sch
262	3946-7659	H. G. Muller	do.	1969	H	680	S	Єhp	---
263	3945-7659	Ray Neiderer	Harrisburg's Kohl Bros.	1958	H	625	S	Єhp	---
264	3943-7658	Gerald Frock	Mummert & Sterner	1967	H	723	V	mg	sch
265	3944-7656	Nevin Barnhart	do.	1966	H	890	H	mg	sch
266	3944-7656	Kenneth Clouser	do.	1967	H	910	H	mg	sch
267	3944-7657	L. W. Geiman	do.	1967	H	865	S	mg	sch
268	3944-7658	C. A. Geeting	do.	1968	H	660	S	mg	sch
269	3945-7654	Roy Craumer	do.	1969	H	865	W	mg	sch
270	3944-7654	R. K. Showalter	do.	---	H	795	S	mg	sch
271	3945-7655	Barry Becker	do.	1969	H	800	H	mg	sch
272	3947-7652	Woodrow Kaltreider	do.	1969	H	710	H	mg	sch
273	3947-7641	Glen Rock Bor.	A. C. Reider	---	U	780	V	mbw	gn
274	3947-7641	do.	---	---	P	800	V	was	sch
275	3947-7641	do.	A. C. Reider	1965	P	800	V	mbw	gn
276	3947-7641	do.	---	---	P	805	V	was	sch
277	3948-7657	Penn Twp.	Harrisburg's Kohl Bros.	1964	H	542	V	Oc	shls
278	3948-7657	National Can Corp.	do.	1959	C	565	S	Oc	shls
279	3947-7657	do.	do.	1959	U	565	S	Oc	shls
280	3948-7657	do.	Paul E. Kohler	1960	C	565	S	Oc	shls
281	3947-7659	Hanover Ice Co.	---	---	C	578	S	Oc	shls
282	3948-7659	Hanover Scrap Processing Co.	---	---	H	590	S	Oc	shls
283	3948-7656	Hanover Canning Co.	---	---	N	595	S	Єk	---
284	3948-7656	do.	---	---	H	595	S	Єk	sh
285	3948-7656	do.	---	---	N	590	S	Єk	sh
286	3947-7658	Fulmer Ice Plant	---	---	U	598	H	Oc	shls
287	3946-7654	O. E. Weber	Mummert & Sterner	1967	H	705	H	mg	sch

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Pumping data			Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25° C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured	Yield (gpm)	Draw-down (feet)	Time (hrs)				
72	---	6	---	---	---	---	---	---	11	430	---	Yo- 214
---	---	---	---	---	---	---	---	---	3	115	---	215
350	---	8	---	10	11/69	250	125	---	---	---	---	220
300	---	---	---	---	---	35	---	---	---	---	---	221
192	---	---	---	---	---	100	---	---	---	---	---	222
800	---	---	---	---	---	100	---	---	---	---	---	223
389	---	8	---	---	10/67	10	---	---	3	---	6.6	224
---	---	8	---	---	---	---	---	---	---	---	---	225
380	60	8	---	56	---	75	---	1	8	385	---	226
380	---	8	---	47	10/67	38	5	1	4	240	5.6	227
600	40	8	---	---	---	---	---	---	---	---	---	228
288	---	8	---	34	4/69	86	26	1	5	295	6.5	229
600	68	6	---	12	10/67	46	---	---	---	125	---	230
194	18	8	---	3	4/69	100	23	1	5	220	---	231
260	110	8	---	3	4/69	80	73	1	3	135	---	232
435	60	8	65;320	25	4/69	110	109	1	4	160	---	233
350	---	8	---	62	10/67	---	---	---	---	---	---	234
100	80	6	---	---	---	35	---	---	---	---	---	235
180	40	6	---	---	---	20	---	---	---	---	---	236
110	60	8	---	9	4/69	33	24	1	2	80	6.2	237
296	90	8	---	44	10/67	31	45	---	2	100	6.1	238
212	22	8	80; 95;112; 135;158;170; 188;198;207	64	10/67	41	---	1	1	50	---	239
---	---	---	---	---	---	14	---	---	---	---	---	240
411	28	8	---	20	7/68	24	12	2	14	530	---	241
300	11	8	---	20	9/51	15	110	5	13	---	---	242
170	15	8	30; 40; 60	4	3/68	20	100	C	3	140	---	243
73	50	6	---	---	---	10	---	---	---	---	---	244
76	---	6	---	60	11/70	3	1	1	2	115	---	245
500	52	6	60; 97;209	53	3/71	13	---	---	---	---	---	246
40	35	6	---	17	4/68	---	---	---	---	---	---	247
100	59	6	---	---	---	15	---	---	1	55	6.1	248
112	23	6	---	34	5/68	11	77	B	---	---	---	249
113	40	6	---	38	5/68	12	24	1	3	135	---	250
120	40	6	---	31	5/68	12	9	1	2	105	---	251
141	33	6	---	30	5/68	13	25	1	2	115	---	252
135	21	6	46	42	5/68	11	10	1	3	125	---	253
149	19	6	50; 62; 67	36	5/68	9	81	1	4	140	---	254
29	---	6	---	28	4/68	---	---	---	---	---	---	255
100	---	6	---	31	4/68	60	---	---	2	105	---	256
210	---	6	---	43	4/68	2	---	---	---	---	---	257
79	---	6	---	30	4/68	---	---	---	---	---	---	258
86	68	6	---	8	9/66	25	---	---	3	165	---	259
117	20	6	---	20	10/69	33	67	3	8	300	6.8	260
120	32	6	51;112	5	10/69	6	46	1	3	140	---	261
120	20	6	---	22	10/69	11	28	1	12	425	---	262
89	19	6	50; 84	20	10/58	6	38	C	10	390	---	263
140	21	6	59;118	8	7/67	3	---	---	3	100	---	264
145	21	6	118	48	9/66	3	---	---	9	360	7.8	265
160	41	6	58; 97	47	6/67	9	96	8	4	180	6.0	266
170	28	6	69	14	10/69	6	85	8	4	120	---	267
160	15	6	40;151	28	10/69	4	76	C	6	265	---	268
200	27	6	106;173	58	10/69	6	95	8	4	175	6.5	269
140	60	6	79;123	19	10/69	5	70	8	5	185	---	270
120	20	6	76;103	51	10/69	6	5	1	3	135	6.9	271
119	23	6	84;107	46	10/69	9	7	1	1	25	5.8	272
110	---	6	---	3	10/67	---	---	---	---	---	---	273
385	---	8	---	90	10/67	17	---	---	---	90	---	274
200	20	8	---	---	10/67	25	---	2	---	85	---	275
310	---	8	---	13	10/67	37	23	1	2	83	6.4	276
100	20	6	40; 90	5	11/69	30	60	8	13	500	7.7	277
298	23	8	---	10	12/59	68	240	24	19	720	---	278
350	---	8	---	---	---	0	---	---	---	---	---	279
350	---	8	---	10	1960	15	300	15	19	720	---	280
415	---	8	---	10	11/69	50	50	6	24	940	---	281
330	---	10	---	30	9/63	80	137	5	23	940	---	282
510	---	6	---	10	11/61	111	330	19	8	330	6.9	283
75	---	6	---	15	---	18	---	---	---	---	---	284
163	---	6	---	10	---	20	---	---	6	---	6.6	285
540	---	8	---	---	---	25	---	---	---	---	---	286
100	23	6	68; 90	20	1/67	8	---	---	3	120	6.5	287

TABLE 17.

Well location Number	Well location Lat-Long	Owner	Oriller	Date completed	Use	Alti-tude of land surface (feet)	Topo-graphic setting	Aquifer Name	Aquifer Compo-sition
Yo- 288	3945-7655	Herbert Yingling	Harrisburg's Kohl Bros.	1965	H	650	V	mg	sch
289	3945-7656	Ray Klinedinst	Mummert & 5terner	1966	H	755	S	mg	sch
290	3945-7657	N. H. 5trausbaugh	do.	1967	H	798	H	mg	sch
291	4000-7634	I. 5. Naylor	---	---	H	320	5	Oc	shls
292	4000-7634	John Buchart	---	---	U	330	5	Oc	shls
293	4000-7634	do.	---	---	H	342	5	Oc	shls
294	4000-7634	Joseph Kindig	---	---	H	320	5	Oc	shls
295	4000-7633	Irvin Naylor	---	---	U	300	S	Oc	shls
296	4000-7634	Herbert Leaman	Paul E. Kohler	1958	C	358	5	Oc	shls
297	3947-7658	Robert Mummert	Mummert & 5terner	1967	H	637	S	Oc	shls
298	3946-7658	N. Grogg	do.	1967	H	740	S	Chp	---
299	3946-7658	Charles McManus	do.	1966	H	700	S	Chp	sh
301	3946-7658	Winnamore Dull	do.	1967	H	700	H	Chp	sch
302	3945-7659	Clair 5terner	do.	1966	H	710	5	mg	sch
303	3945-7659	8enjamin Bollinger	do.	1967	H	640	5	mg	sch
304	3945-7658	Robert Lippy	do.	1966	H	610	V	mg	sch
305	3945-7657	K. R. Fuhrman	do.	1966	H	770	H	Chp	---
306	3945-7657	H. 5chaeffer	do.	1967	H	775	H	Chp	---
307	3944-7656	Gilbert 5ullivan	do.	1966	H	885	H	mg	sch
308	3945-7657	Richard Jones	William W. Reichart	1966	H	767	5	Chp	---
309	3945-7657	Oavid 8ecker	Mummert & 5terner	1966	H	760	H	Chp	---
310	3946-7656	Ray Forbes	do.	1967	H	710	5	mg	sch
311	3946-7656	Clinton Oull	do.	1966	H	725	H	mg	sch
312	3946-7657	5eventh Oay Adventist Ch.	do.	1966	H	765	H	Chp	---
313	3946-7658	Clair McManus	do.	1966	H	705	H	Chp	---
314	3946-7656	Raymond Wetzel	do.	1966	H	680	5	Chp	---
315	3945-7653	John Ruhlman	do.	1966	H	880	5	mg	sch
316	3948-7654	Camp Pamadeva	William W. Reichart	1966	H	635	5	Ck	sh
317	3948-7655	do.	do.	1966	H	655	H	Chp	---
318	3948-7654	do.	do.	1968	H	663	5	Ck	sh
319	3947-7656	K. R. Helwig	Mummert & 5terner	1966	H	745	H	Chp	---
320	3947-7656	J. D. Sterner	do.	1964	H	743	H	Chp	---
321	3946-7654	Marlin Geiman	do.	1966	H	745	H	mg	sch
322	3946-7654	Frances Brown	do.	1970	H	730	H	mg	sch
323	3947-7656	Larry 8ankert	do.	1966	H	780	H	Chp	---
324	3947-7656	Melvin Renoll	do.	1967	H	745	H	Chp	---
325	3947-7655	Harry 5terner	do.	1966	H	675	W	Chp	---
326	3948-7653	Merle 8oyer	do.	1966	H	725	H	Chp	---
327	3949-7653	Carlton 5eed Co.	William W. Reichart	1950	H	510	V	Chp	---
328	3949-7653	Franklin 5terner	do.	1966	H	520	V	Chp	---
329	3949-7654	Carl Main	Mummert & 5terner	1967	H	685	H	Chp	---
330	3949-7657	Ralph Schuman	do.	1967	H	583	H	Oc	shls
331	3950-7655	John Ousman	do.	1967	H	590	S	Ca	---
332	3951-7656	W. R. Record	do.	1966	H	770	S	Cc	---
333	3951-7655	H. C. Lemmon, Jr.	Harrisburg's Kohl 8ros.	1966	H	690	5	Chp	---
334	3951-7655	Oale Mummert	Mummert & 5terner	1967	H	705	5	Chp	---
335	3946-7658	O. G. Bair	William W. Reichart	1966	H	720	5	Chp	---
336	3945-7657	Howard Markel	Mummert & 5terner	1967	H	782	H	Chp	---
337	3950-7657	Jacob Albright	Harrisburg's Kohl 8ros.	1962	H	690	V	Cc	---
338	3949-7658	Calvary 8ible 8aptist Ch.	---	1955	H	593	5	Oc	shls
339	3949-7655	Roy Dehoff	Mummert & 5terner	1967	H	647	H	Chp	---
340	3949-7654	Ronald Gephart	do.	1966	H	660	S	Chp	---
341	3950-7653	Elwelter 5owers	Young 8ros.	1966	H	480	V	Ck	sh
342	3952-7655	Mary Harman	William W. Reichart	1966	H	800	5	Cc	---
343	3951-7656	Roger Oiller	---	---	H	955	S	Cc	sch
344	3952-7652	R. E. Luckenbaugh	Young Bros.	1966	H	520	5	Cv	dol
345	3952-7653	K. E. Stough	William W. Reichart	1967	H	500	5	Cv	dol
346	3950-7654	C. A. Wentz	Young Bros.	1966	H	585	5	Chp	---
347	3950-7653	Robert Hiltebridle	Mummert & 5terner	1966	H	505	5	Ck	sh
348	3951-7653	Lester Ferrence	William W. Reichart	1967	H	510	V	Ck	sh
349	3952-7656	R. W. 5owers	Mummert & Sterner	1968	H	805	5	mb	gn
350	3953-7655	E. L. Laughman	---	1920	H	740	5	Cc	cong
351	3952-7654	Charles Hartman	Young 8ros.	1965	H	785	H	Cc	---
352	3953-7654	8radley 5heridan	---	---	H	715	5	Cc	---
353	3953-7653	G. E. 5enft	Young 8ros.	1967	H	655	5	Chp	sh
354	3953-7653	N. E. Elehwany	do.	1969	H	610	W	Chp	---
355	3952-7653	Lester 5hearer	---	1932	H	520	S	Ca	---
356	3955-7652	G. A. Elicker	---	1920	H	475	V	Cv	dol
357	3955-7653	do.	Young 8ros.	1966	H	481	V	Cv	dol
358	3954-7654	R. D. 5terner	Mummert & 5terner	1958	H	660	5	Cc	---
359	3953-7653	Anthony Liberator	do.	1968	H	595	W	Chp	---
360	3954-7653	Roth Ch.	---	1960	H	625	H	Chp	---

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Pumping data			Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25° C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured	Yield (gpm)	Draw-down (feet)	Time (hrs)				
41	17	6	25; 38	5	11/65	10	---	---	3	125	---	Yo- 288
120	20	6	74	34	8/66	7	---	---	5	215	6.5	289
160	41	6	94;130	50	8/67	7	---	---	---	---	---	290
60	---	6	---	20	5/70	6	1	1	13	500	---	291
65	---	6	---	23	5/70	23	8	2	12	405	---	292
51	---	6	---	36	9/65	20	---	---	---	---	---	293
130	---	6	---	33	5/70	9	1	2	16	550	---	294
40	---	6	---	15	5/70	---	---	---	11	475	---	295
135	12	6	---	28	5/70	4	---	---	16	550	---	296
100	50	6	71; 94	7	6/67	11	---	---	---	---	---	297
100	41	6	---	33	9/67	10	---	---	---	---	---	298
100	31	6	61; 83	26	5/66	10	---	---	---	105	---	299
120	20	6	68;112	32	5/67	7	---	---	---	250	---	301
140	25	6	87;124	40	6/66	4	---	---	2	75	---	302
140	38	6	121	31	2/67	4	---	---	---	---	---	303
130	22	6	123	2	6/66	8	---	---	2	75	---	304
165	63	6	152	40	10/66	3	---	---	---	---	---	305
100	40	6	70; 93	40	4/67	9	---	---	---	---	---	306
125	26	6	68	34	8/66	5	---	---	---	---	---	307
109	31	6	44; 66	36	10/66	20	---	---	---	---	---	308
140	21	6	120	25	10/66	5	---	---	---	---	---	309
100	41	6	59; 88	30	7/67	10	---	---	2	100	---	310
160	44	6	141	28	6/66	2	---	---	5	310	---	311
105	25	6	61; 83	50	8/66	9	---	---	5	170	---	312
120	22	6	96	35	5/66	6	---	---	---	---	---	313
120	22	6	68; 96	46	7/66	6	---	---	---	---	---	314
200	21	6	63	40	9/66	1	---	---	1	50	---	315
150	20	6	35; 85	16	7/70	9	100	B	4	265	---	316
100	31	6	37; 82	15	7/70	7	27	1	8	400	---	317
233	35	6	---	26	7/70	---	---	---	9	400	---	318
105	21	6	80	18	10/66	10	---	---	---	---	---	319
145	20	6	---	---	1/64	14	---	---	2	100	---	320
180	22	6	81	25	10/66	1	---	---	7	255	---	321
98	---	6	36	24	8/70	6	35	2	6	280	---	322
225	39	6	77;214	48	7/70	8	---	---	2	100	---	323
140	26	6	58;118	21	7/70	5	---	---	9	425	---	324
80	20	6	61	9	9/66	6	---	---	---	---	---	325
190	21	6	84	39	7/66	2	---	---	2	95	---	326
43	---	6	---	9	7/70	5	24	1	5	360	---	327
103	30	6	48; 93	30	8/66	20	---	---	---	---	---	328
80	41	6	58; 64	32	6/67	10	---	---	1	70	5.5	329
40	33	6	35	12	6/67	20	---	---	9	350	---	330
100	41	6	89	50	7/67	12	---	---	3	100	---	331
125	38	6	64;107	30	8/66	9	---	---	---	---	---	332
117	30	6	50;112	49	7/70	6	57	1	4	125	---	333
140	61	6	70;128	50	5/67	6	---	---	4	160	---	334
170	37	6	47;160	28	8/66	9	---	---	---	100	---	335
100	40	6	78	50	5/67	10	---	---	---	---	---	336
90	56	6	40; 85	55	8/70	7	3	1	2	60	---	337
40	---	6	---	13	8/70	6	5	1	14	590	7.0	338
100	25	6	78; 89	35	7/67	10	---	---	3	130	---	339
120	22	6	69;106	12	6/66	5	---	---	---	---	---	340
50	38	6	22; 42	7	8/70	5	3	1	3	120	---	341
125	68	6	48; 76;115	22	12/66	14	---	---	4	135	---	342
57	---	6	---	17	8/70	8	---	1	1	25	---	343
100	70	6	78; 93	42	8/66	20	---	---	12	450	---	344
73	38	6	44; 65	31	8/70	9	3	1	15	550	7.5	345
63	20	6	35; 56	13	12/66	15	---	---	6	300	---	346
195	81	6	178	70	8/66	2	---	---	---	---	---	347
70	46	6	58	15	7/67	20	---	---	4	145	5.5	348
60	40	6	---	31	8/70	10	23	A	1	25	---	349
62	---	6	---	30	8/70	5	---	---	2	270	---	350
110	---	6	---	50	6/65	15	1	1	1	25	---	351
94	---	6	---	35	8/70	4	44	A	1	30	6.0	352
205	68	6	70;138	55	5/67	2	---	---	4	180	---	353
250	50	6	70;160;200; 220	16	8/70	8	47	1	5	205	---	354
97	---	6	---	26	8/70	5	27	1	2	70	5.8	355
50	---	6	---	8	8/70	---	---	---	10	370	7.5	356
220	40	6	---	8	8/70	10	40	A	14	560	7.5	357
95	20	6	---	9	8/70	3	---	---	2	100	6.0	358
100	20	6	41; 94	8	8/70	5	---	---	6	275	7.3	359
105	---	6	---	56	8/70	3	---	---	5	200	6.8	360

TABLE 17.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer	
Number	Lat-Long							Name	Composition
Yo- 361	3952-7651	P. H. Glatfelter Pulp Co.	Harrisburg's Kohl Bros.	1955	P	445	V	Cl	dol
362	3952-7650	do.	York Drilling Co., Inc.	1967	H	455	V	Ꞓl	dol
363	3948-7652	P. H. Glatfelter Co.	---	---	H	515	V	Ꞓc	sch
364	3954-7650	Pine Springs Water Co.	---	1954	P	505	H	Cv	dol
365	3954-7651	Jackson Twp. Water Authority	A. C. Reider & Son, Inc.	1969	P	520	H	Ck	sh
366	3953-7651	Cletus Mummert	Mummert & Sterner	1935	I	475	V	Ꞓv	dol
367	3951-7650	Walter Moul	do.	1970	H	680	H	Chp	---
368	3951-7650	W. A. Kurtz, Jr.	do.	1967	H	685	H	Ꞓhp	sh
369	3951-7650	C. V. Hunt	do.	1967	H	687	H	Ꞓhp	---
370	3951-7650	Ross Stambaugh	Young Bros.	1966	H	620	S	Ꞓhp	---
371	3950-7650	G. H. Smith	do.	1967	H	823	H	Ꞓc	---
372	3950-7650	Luther Stoner	do.	1966	H	690	V	Ꞓc	---
373	3951-7648	H. R. Palmer	do.	1966	H	865	H	Ꞓc	---
374	3951-7649	Luther Wildasin	do.	1967	H	655	H	Chp	---
375	3951-7649	Ch. of the Brethren	do.	1967	H	665	H	Ꞓhp	---
376	3959-7649	Morris Copp	do.	1967	H	745	S	Ꞓc	---
377	3952-7648	John Klingaman	do.	1967	H	750	H	Ꞓhp	---
378	3952-7649	Glenn Bare	do.	1966	H	605	H	Ꞓhp	---
379	3952-7649	N. L. Gentzler	do.	1966	H	580	S	Ꞓhp	---
380	3953-7650	Henry Schaeberle	William W. Reichart	1967	H	510	H	Cv	dol
381	3953-7650	Fred Bange	do.	1967	H	510	H	Ꞓk	ls
382	3954-7651	Robert Hoover	Young Bros.	1966	H	602	H	Chp	---
383	3953-7652	Clair Bentzel	do.	1966	H	660	S	Ꞓc	---
384	3953-7651	J. S. Lewis	do.	1966	H	502	H	Cv	dol
385	3952-7650	N. G. Martin	York Drilling Co., Inc.	1966	H	440	V	Cl	dol
386	3952-7649	Walter Blankenstein	Young Bros.	1967	H	620	H	Chp	---
387	3953-7649	Roger Goodling	do.	1966	H	600	H	Ꞓhp	---
388	3952-7649	W. E. Bankert	do.	1967	H	605	H	Ꞓhp	---
389	3952-7650	George Sterner	do.	1966	H	650	H	Chp	---
390	3952-7651	John Dickert	do.	1967	H	665	H	Ꞓhp	---
391	3951-7652	Lawrence Myers	do.	1966	H	640	H	Ꞓhp	---
392	3950-7651	Curvin Sterner	do.	1967	H	830	S	Ꞓc	---
393	3949-7650	Lewis Trostle	William W. Reichart	1966	H	650	V	Ꞓa	---
394	3949-7640	Vincent Kislowski	A. C. Reider & Son, Inc.	1966	H	710	V	mbw	sch
395	3950-7640	Oscar Whitacre	do.	1967	H	660	S	was	sch
396	3950-7640	O. W. Hadson	York Drilling Co., Inc.	1964	H	865	H	mg	metf
397	3950-7640	Marvin Godfrey	A. C. Reider & Son, Inc.	1966	H	715	W	mg	sch
398	3948-7642	Harry Markel	Young Bros.	1967	H	810	H	was	sch
399	3948-7641	Robert Franklin	A. C. Reider & Son, Inc.	1966	H	810	S	was	sch
400	3947-7643	Jacob Raven, Jr.	do.	1965	H	635	S	mbw	---
401	3947-7644	Earl M. Kiser	do.	1967	H	590	S	was	sch
402	3945-7644	T. C. Coleman	---	---	H	665	W	mbw	---
403	3945-7644	Kenneth Abel	A. C. Reider & Son, Inc.	1966	---	660	V	mbw	---
404	3948-7659	Utz Potato Chip Co.	---	1956	C	610	S	Oc	shls
405	3944-7640	Guy Leader	---	---	H	870	W	was	sch
406	3943-7644	Russell Cornbower	A. C. Reider & Son, Inc.	1966	H	870	S	was	---
407	3944-7641	Guy Leader	---	---	H	920	W	was	---
408	3943-7640	Mrs. Ida Harman	A. C. Reider & Son, Inc.	1966	H	885	S	was	---
409	3946-7638	C. E. Wilson	William Coy James	1966	H	910	S	was	sch
410	3945-7638	Russell Hill	A. C. Reider & Son, Inc.	1964	---	860	V	was	sch
411	3944-7638	Samuel Lentz, Jr.	do.	1967	H	710	V	was	sch
412	3944-7638	J. K. Wolfe	do.	1967	---	755	S	was	sch
413	3945-7640	Superior Wire Cloth Co.	do.	1962	N	915	S	was	sch
414	3945-7640	do.	do.	1962	N	805	W	was	sch
415	3944-7630	F. J. Caulfield	do.	1965	H	700	S	was	sch
416	3945-7641	Shrewsbury Bor.	do.	1969	U	920	W	mbw	---
417	3945-7640	do.	---	---	P	940	H	was	sch
418	3945-7641	do.	A. C. Reider & Son, Inc.	1954	P	900	W	was	sch
419	3946-7641	do.	do.	1965	P	910	H	was	sch
420	3946-7640	do.	do.	1963	P	860	W	was	sch
421	3952-7632	Mrs. Nolan Craley	do.	1967	H	830	S	was	sch
422	3952-7634	Clayton Tyson	---	1957	H	655	S	was	sch
423	3952-7632	L. E. Burke	A. C. Reider & Son, Inc.	1966	H	860	H	was	sch
424	3948-7633	Norman Norris	---	---	H	790	H	was	sch
425	3950-7634	N. E. Downs	A. C. Reider & Son, Inc.	1966	H	835	H	was	sch
426	3951-7635	David Anderson	do.	1967	H	660	H	was	sch
427	3951-7634	Dennis Miller	do.	1966	H	600	S	was	sch
428	3944-7627	Helen Ruff	do.	1948	H	710	H	was	sch
429	3944-7627	Roland Morris	do.	1967	---	710	H	was	sch
430	3944-7627	James Howell	do.	1967	---	710	H	was	sch
431	3943-7628	Mason & Dixon Hunt Club	do.	1966	---	700	S	was	sch
432	3943-7628	V. S. Morris	do.	1966	---	710	S	was	sch
433	3948-7659	Utz Potato Chip Co.	---	---	C	595	S	Oc	shls

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Pumping data			Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25° C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured	Yield (gpm)	Draw-down (feet)	Time (hrs)				
624	---	10	---	14	1955	464	233	1	19	520	8.0	Yo- 361
45	---	6	---	5	8/70	10	2	2	7	260	7.5	362
327	---	6	---	9	8/70	14	79	1	2	75	5.5	363
830	---	8	---	---	---	300	---	---	---	---	---	364
650	---	6	120;366	57	8/70	13	140	24	8	375	---	365
51	15	6	---	10	8/70	7	7	1	16	750	8.0	366
100	16	6	86	43	8/70	6	6	1	3	100	6.0	367
100	32	6	94	21	4/67	100	---	---	3	140	6.5	368
100	22	6	60; 90	50	7/67	10	---	---	2	125	6.0	369
71	27	6	27; 60	16	8/66	20	---	---	---	---	---	370
100	30	6	58; 88	46	8/70	20	---	---	1	50	---	371
54	29	6	44	6	8/70	3	5	1	1	25	6.0	372
136	67	6	66;105;127	40	8/70	4	50	1	2	75	6.0	373
120	45	6	58;108	44	4/67	6	---	---	3	130	6.0	374
167	25	6	44; 70;160	40	8/70	3	---	---	---	---	---	375
207	41	6	135;178	25	8/70	3	59	1	4	160	6.5	376
84	31	6	63; 74	39	7/67	25	---	---	1	35	6.0	377
140	26	6	38; 95	30	7/66	5	---	---	---	---	---	378
127	29	6	42	29	7/66	3	---	---	5	240	6.0	379
160	44	6	58;148	45	7/67	5	---	---	---	---	---	380
69	55	6	35; 62	30	7/67	20	---	---	6	250	6.5	381
175	31	6	82;138;160	61	8/70	10	---	---	4	200	7.0	382
187	46	6	95;162	57	6/66	4	---	---	---	---	---	383
200	49	6	57; 66	54	8/66	4	---	---	---	---	---	384
100	18	6	50; 95	9	9/66	15	---	---	18	590	8.0	385
228	40	6	60; 88;190	40	6/67	6	---	---	5	340	6.0	386
105	30	6	42; 95	30	7/67	12	---	---	---	---	---	387
180	26	6	44;170	28	3/67	15	---	---	4	220	6.5	388
110	31	6	61; 87;100	42	8/66	8	---	---	---	---	---	389
200	32	6	68;167	53	3/67	5	---	---	---	---	---	390
82	26	6	37; 51	17	9/70	8	21	1	4	220	6.0	391
147	43	6	55;114	42	9/70	7	---	---	---	---	---	392
94	86	6	43; 85	30	9/66	3	1	1	3	160	6.0	393
44	27	6	---	---	---	10	---	---	4	205	6.4	394
80	20	6	---	---	---	10	---	---	3	150	---	395
500	13	6	60;395	---	---	1	---	---	4	280	6.3	396
54	40	6	---	---	---	6	---	---	2	110	5.4	397
276	26	8	77	---	1/67	6	---	---	---	---	---	398
75	69	6	---	---	---	20	---	---	---	---	---	399
70	42	6	---	---	---	---	---	---	2	150	6.9	400
110	40	6	---	---	---	5	---	---	---	---	---	401
140	---	6	---	4	8/70	13	6	1	4	240	6.8	402
47	24	6	---	---	---	15	---	---	---	---	---	403
382	---	8	---	8	11/69	42	244	2	12	440	---	404
140	---	6	---	9	8/70	10	20	1	2	160	5.1	405
107	74	6	---	15	8/70	5	4	1	4	290	---	406
164	---	6	---	58	8/70	4	21	1	2	170	6.0	407
106	73	6	---	---	---	5	---	---	---	---	---	408
134	21	6	64	53	8/70	3	3	1	1	65	---	409
56	25	6	---	---	---	6	---	---	2	90	---	410
50	38	6	---	---	---	15	---	---	1	95	6.4	411
103	62	6	---	---	---	7	---	---	---	---	---	412
200	100	6	---	30	8/70	15	70	1	5	265	6.7	413
130	---	10	---	---	---	20	---	---	---	---	---	414
81	24	6	---	37	8/70	9	4	1	1	97	---	415
200	---	---	---	22	10/70	18	22	1	5	310	6.5	416
180	36	8	---	54	8/70	11	34	1	2	100	5.8	417
204	---	8	---	16	8/70	43	18	1	2	190	---	418
220	---	---	---	50	8/70	30	6	1	2	120	5.9	419
220	20	8	---	9	8/70	21	8	1	2	120	5.1	420
88	65	6	---	---	---	10	---	---	---	---	---	421
92	18	6	---	40	8/70	7	20	1	3	180	5.5	422
90	23	6	---	39	8/70	6	3	1	1	50	---	423
120	20	6	---	39	8/70	7	66	A	4	285	6.9	424
125	22	6	---	53	8/70	6	6	1	2	110	---	425
200	32	6	---	---	---	3	---	---	1	60	5.4	426
74	18	6	---	---	8/70	20	---	---	5	350	5.0	427
106	---	6	---	46	8/70	5	14	1	2	130	5.0	428
170	63	---	---	---	---	1	---	---	---	---	---	429
120	49	---	---	---	---	7	---	---	---	---	---	430
71	48	---	---	---	---	24	---	---	---	---	---	431
72	58	---	---	---	---	20	---	---	---	---	---	432
165	---	6	---	10	11/69	79	31	6	12	430	---	433

TABLE 17.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer	
Number	Lat-Long							Name	Composition
Yo- 434	3945-7627	H. M. Riley	A. C. Reider & Son, Inc.	1966	---	610	H	was	sch
435	3946-7633	Lewis Hiltz	do.	1967	H	880	S	was	sch
436	3946-7634	Clyde Seaks	do.	1966	H	805	W	was	sch
437	3952-7629	Dennis Bacon	---	1967	H	840	H	was	sch
438	3946-7637	J. F. Burkholder	A. C. Reider & Son, Inc.	1966	H	985	H	was	sch
439	3947-7638	Howard Horton	do.	1966	---	1100	H	was	sch
440	3946-7635	H. W. Jenkins	do.	1964	---	945	H	was	sch
441	3946-7636	J. R. Wolf	do.	1967	---	875	S	was	sch
442	3947-7625	A. R. Grase	do.	1966	H	350	S	was	sch
443	3947-7625	A. P. Latterman	do.	1966	---	445	V	was	sch
444	3947-7625	Meeks Garage	do.	1964	H	460	S	was	sch
445	3945-7627	J. W. Mink	do.	1966	H	600	H	was	sch
446	3946-7628	W. J. Dietz	do.	1968	---	710	S	was	sch
447	3946-7628	L. P. Fletcher	do.	1966	H	710	S	was	sch
448	3945-7628	Lester Channell	do.	1966	H	800	H	was	sch
449	3951-7630	St. James Lutheran Ch.	---	---	T	740	S	was	sch
450	3947-7620	Hazel McGurk	A. C. Reider & Son, Inc.	1967	H	615	H	was	sch
451	3947-7620	Harvey Pomeraning	do.	1966	---	625	H	was	sch
452	3947-7620	R. O. Hess	---	1967	H	630	H	was	sch
453	3944-7623	W. J. Miller	A. C. Reider & Son, Inc.	1966	C	560	S	was	sch
454	3952-7628	U. G. Forry	do.	1967	H	845	H	was	sch
455	3951-7630	Roger McWilliams	do.	1967	H	740	S	was	sch
456	3952-7627	R. E. Daugherty	do.	1966	H	740	S	was	sch
457	3953-7629	Wilbur Grothe	do.	1968	---	820	S	was	sch
458	3953-7626	R. C. Jacobs	do.	1965	---	885	H	was	sch
459	3952-7630	R. E. Brown	do.	1967	---	825	S	was	sch
460	3952-7629	Markel Bros.	do.	1966	H	580	H	was	sch
461	3951-7629	Raymond Tompkins	do.	1965	---	845	H	was	sch
462	3950-7629	Roy Flaharty	---	1966	H	730	S	was	sch
463	3951-7625	Howard Grove	A. C. Reider & Son, Inc.	1967	H	665	S	was	sch
464	3951-7627	Paul Curran	do.	1966	H	750	S	was	sch
465	3951-7627	Stewart Kilgore	do.	1967	---	690	S	was	sch
466	3945-7635	Stewartstown Water Co.	Harrisburg's Kohl Bros.	1942	P	860	S	was	sch
467	3945-7635	do.	do.	1955	P	850	S	was	sch
468	3945-7635	Stewartstown Water Co.	do.	1905	P	860	S	was	sch
469	4000-7634	U. S. Geol. Survey	York Drilling Co., Inc.	1970	U	312	W	Oc	shls
470	4000-7634	do.	do.	1970	U	357	W	Oc	shls
471	4000-7634	do.	do.	1970	U	330	W	Oc	shls
472	3944-7634	do.	do.	1970	U	800	W	was	sch
473	3944-7634	do.	do.	1970	U	760	V	was	sch
474	3950-7624	L. S. Richardson	A. C. Reider & Son, Inc.	1966	H	785	S	was	sch
475	3948-7622	W. F. Miller	do.	1966	H	655	H	was	sch
476	3948-7618	O. A. Brown	do.	1967	---	215	S	was	sch
477	3949-7623	Emory Kilgore	do.	1965	---	670	W	was	sch
478	3949-7621	do.	do.	1967	---	635	H	was	sch
479	3949-7621	do.	do.	1967	H	640	H	was	sch
480	3945-7624	R. E. Kilgore	do.	1966	---	560	S	was	sch
481	3946-7624	H. W. Ruff	do.	1966	H	315	V	was	sch
482	3947-7630	Ronald Flaharty	do.	1968	H	610	V	was	sch
483	3948-7628	Stephen Shepard	do.	1966	H	620	H	was	sch
484	3950-7642	Loganville Bor.	---	---	U	850	H	mg	sch
485	3951-7627	Melvin Wessel	A. C. Reider & Son, Inc.	1966	W	680	H	was	sch
486	3949-7627	James Reed	do.	1966	---	660	H	was	sch
487	3947-7629	K. V. Trout	do.	1966	S	630	H	was	sch
488	4000-7635	Richard Allison	James P. Kohler	1967	S	350	S	Oc	shls
489	4000-7635	do.	---	---	H	340	V	Oc	shls
490	3959-7635	W. B. Dietz	---	1962	H	590	S	Cc	sch
491	3959-7635	Eastern York Sch. Dist.	---	---	H	360	S	Oc	shls
492	3959-7635	R. B. Snyder	Paul E. Kohler	---	H	415	S	Oc	shls
493	3959-7635	George Picking	---	1967	H	395	S	Oc	shls
494	3944-7634	Anderson Fruit Farm	---	---	C	785	H	was	sch
495	3944-7634	do.	A. C. Reider & Son, Inc.	1965	---	770	H	was	sch
496	3944-7637	Blevins Fruit Farm	---	---	C	780	H	was	sch
497	3943-7637	James Deel	A. C. Reider & Son, Inc.	1969	H	780	W	was	sch
498	3943-7636	Howard Hughes	Ray J. Urey	1959	O	620	W	was	sch
499	3943-7636	Quint McCleary	do.	1947	H	730	H	was	sch
500	3943-7617	S. Stewart	---	1920	H	485	H	pc	sch
501	3944-7617	Sam Stewart	---	1920	---	490	H	pb	sch
502	3948-7659	Utz Potato Chip Co.	York Drilling Co., Inc.	---	C	605	S	Oc	shls
503	3943-7618	William Rhodes	A. C. Reider & Son, Inc.	---	H	560	H	pb	sch
504	3943-7618	do.	---	---	S	560	H	pb	sch
505	3946-7620	Snyder Packing Co.	---	1934	C	450	S	was	sch
506	3946-7670	do.	A. C. Reider & Son, Inc.	1966	H	500	H	was	sch
507	3944-7620	Stoner	do.	1963	R	445	H	pc	sch
508	3948-7622	J. K. Anderson	do.	1966	H	660	S	was	sch

(CONTINUED)

Total depth below land surface (feet)	Casing Depth (feet)	Casing Diameter (inches)	Depth(s) to water-bearing zone(s) (feet)	Static water level: Depth below land surface (feet)	Static water level: Date measured	Pumping data: Yield (gpm)	Pumping data: Drawdown (feet)	Pumping data: Time (hrs)	Hardness (gpg)	Specific conductance (micromhos at 25° C)	pH	Well number
111	24	---	---	---	---	4	---	---	---	---	---	Yo- 434
104	50	6	---	---	---	11	---	---	---	---	---	435
32	21	6	---	13	---	3	1	1	2	120	5.9	436
125	16	6	70;105	---	4/67	10	36	1	---	---	---	437
85	23	6	---	---	---	10	---	---	1	50	6.1	438
175	29	---	---	---	---	1	---	---	---	---	---	439
104	42	---	---	---	---	30	---	---	---	---	---	440
140	32	---	---	---	---	5	---	---	2	115	5.3	441
50	18	6	---	15	7/70	8	1	1	2	145	6.25	442
50	23	6	---	---	---	30	---	---	---	---	---	443
62	33	6	---	---	---	12	---	---	---	---	---	444
120	50	6	---	---	---	4	---	---	1	50	5.2	445
140	76	---	---	---	---	9	---	---	---	---	---	446
100	23	6	---	---	---	20	---	---	2	190	---	447
110	23	6	---	---	---	15	---	---	2	160	---	448
108	---	6	---	62	7/70	6	37	C	1	50	---	449
100	72	6	---	---	---	20	---	---	2	85	---	450
129	46	---	---	---	---	10	---	---	---	---	---	451
225	55	6	---	---	---	2	---	---	---	---	---	452
50	20	6	---	10	7/70	12	2	1	2	140	5.3	453
100	40	6	---	---	---	20	---	---	---	---	---	454
155	44	6	---	---	---	1	---	---	---	---	---	455
100	21	6	---	---	---	15	---	---	---	---	---	456
100	23	---	---	---	---	10	---	---	---	---	---	457
100	21	---	---	---	---	8	---	---	---	---	---	458
80	24	---	---	---	---	10	---	---	---	---	---	459
115	59	6	---	57	7/70	4	4	1	---	295	---	460
150	11	6	---	---	---	3	---	---	---	---	---	461
107	16	6	---	---	9/66	4	---	---	---	---	---	462
105	30	6	---	33	7/70	5	28	1	7	560	5.75	463
90	42	6	---	---	---	20	---	---	---	---	---	464
78	52	6	---	---	---	20	---	---	---	---	---	465
236	60	8	---	---	---	40	---	---	---	---	---	466
130	60	8	---	7	7/70	22	30	1	---	---	---	467
150	35	6	---	17	7/70	22	11	1	---	225	---	468
125	21	6	108	13	7/70	4	85	C	15	---	---	469
43	42	6	47	28	7/70	9	1	1	13	---	---	470
160	24	6	121	29	6/70	8	59	1	13	550	7.0	471
125	50	6	63	16	6/70	7	40	1	2	100	---	472
120	47	6	60	5	6/70	24	25	4	2	85	---	473
110	25	6	---	---	---	4	---	---	---	---	---	474
120	109	6	---	---	---	10	---	---	---	---	---	475
80	20	---	---	---	---	2	---	---	---	---	---	476
80	37	---	---	---	---	5	---	---	---	---	---	477
95	36	---	---	---	---	4	---	---	---	---	---	478
100	35	6	---	32	6/70	10	---	---	3	75	---	479
60	21	---	---	---	---	35	---	---	---	---	---	480
35	22	---	---	---	---	28	---	---	---	---	---	481
173	45	6	---	---	---	6	---	---	---	---	---	482
118	34	---	---	---	---	1	---	---	---	---	---	483
158	55	---	---	---	8/63	5	21	C	---	---	---	484
110	50	---	---	---	---	4	---	---	---	---	---	485
93	69	---	---	---	---	10	---	---	---	---	---	486
95	50	6	---	58	6/70	11	12	1	5	260	---	487
350	23	6	---	---	---	6	----	---	---	---	---	488
165	---	6	---	---	---	20	---	---	---	---	---	489
160	20	6	---	52	5/70	6	86	B	---	---	---	490
250	---	6	---	39	5/70	12	1	1	17	650	---	491
50	---	6	---	35	5/70	---	---	---	---	---	---	492
90	0	6	---	23	5/70	6	1	1	6	250	---	493
120	---	6	---	---	---	---	---	---	---	---	---	494
200	75	6	---	34	5/70	19	51	1	10	500	---	495
116	---	6	---	67	5/70	5	32	C	2	65	---	496
105	28	6	---	---	---	11	---	---	---	---	---	497
67	---	---	---	---	---	---	---	---	---	---	---	498
88	36	6	---	---	---	7	---	---	---	---	---	499
65	30	6	---	50	---	---	---	---	3	220	5.3	500
65	30	---	---	---	---	---	---	---	1	40	5.3	501
285	---	8	---	12	12/69	45	83	2	11	425	---	502
111	70	6	---	45	5/69	8	14	1	---	130	6.2	503
70	---	---	---	---	---	---	---	---	---	70	6.2	504
40	10	6	---	8	12/69	24	8	1	---	100	5.6	505
144	50	6	---	68	5/69	18	14	1	---	180	5.5	506
114	20	6	---	31	4/69	25	35	1	2	165	---	507
110	31	6	---	---	---	10	---	---	---	50	6.6	508

TABLE 17.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer	
Number	Lat-Long							Name	Composition
Yo- 509	3946-7618	C. T. Markel	---	1930	H	305	S	pc	sch
510	3946-7618	Margaret Lay	---	1915	H	400	S	pc	sch
511	3945-7617	Dale Robinson	---	1930	H	360	S	pc	sch
512	3945-7616	Warner Finch	A. C. Reider & Son, Inc.	1968	H	270	V	pc	sch
513	3944-7616	Charles Stewart	---	---	H	460	S	pb	sch
514	3943-7620	John Henck	A. C. Reider & Son, Inc.	1967	H	425	S	pc	sch
515	3944-7618	L. K. Stone	---	---	H	420	S	pc	sch
516	3944-7618	William Wiley	A. C. Reider & Son, Inc.	1963	H	510	H	pc	sch
517	3945-7616	Peach Bottom Atomic Energy Plant	Harrisburg's Kohl Bros.	1962	C	140	V	pc	sch
518	3946-7639	Pa. Highway Maintenance Dept.	do.	1969	U	820	S	was	sch
519	3943-7626	Thomas McShane	A. C. Reider & Son, Inc.	1969	H	660	W	was	sch
520	3945-7625	C. J. Richardson	do.	1966	H	530	S	was	sch
521	3945-7625	Edgar Pyle	---	---	H	600	H	was	sch
522	3944-7635	Blevins Fruit Farm	A. C. Reider & Son, Inc.	1965	U	830	H	was	sch
523	3944-7635	do.	---	1940	H	825	H	was	sch
524	3944-7630	V. M. Grove	A. C. Reider & Son, Inc.	1967	H	790	H	was	sch
525	3947-7637	Kenneth Willwert	do.	1967	H	940	S	was	sch
526	3947-7636	---	do.	1969	---	890	H	was	sch
527	3945-7635	Charles Shanbarger Canning Factory	---	1947	N	825	W	was	sch
528	3945-7635	do.	---	1952	N	825	W	was	sch
529	3943-7625	Everett Richardson	---	1920	H	650	S	was	sch
530	3947-7621	C. L. Wambaugh	---	1936	H	610	H	was	sch
531	3947-7620	J. S. Stephens	---	1941	H	520	S	was	sch
532	3947-7619	Paul Ebaugh	A. C. Reider & Son, Inc.	1967	H	585	S	was	sch
533	3947-7621	Robert Krouse	Ray J. Urey	1962	H	475	S	was	sch
534	3946-7619	O. W. Fox Co.	A. C. Reider & Son, Inc.	1969	H	460	H	was	sch
535	3947-7634	Alvin Hyson	---	1957	H	800	S	was	sch
536	3946-7621	Don Taylor	---	---	---	560	S	was	sch
537	3943-7625	Larry Cox	Gurvis B. Jones	1969	H	620	S	was	sch
538	3951-7623	M. K. Walker	A. C. Reider & Son, Inc.	1966	H	610	W	was	sch
539	3943-7635	William Blevins	---	---	H	730	S	was	sch
540	3944-7635	L. V. Blevins	---	---	H	825	H	was	sch
541	3943-7635	James Hackler	A. C. Reider & Son, Inc.	1965	H	790	H	was	sch
542	3944-7635	Malcolm Fulton	Ray J. Urey	1943	H	860	H	was	sch
543	3943-7634	Jordan Bros.	---	1931	H	765	H	was	sch
544	3944-7635	Nelson McCleary	---	1917	H	845	H	was	sch
545	3944-7635	American Legion	---	1969	H	860	H	was	sch
546	3958-7641	Memorial Osteopathic Hosp.	York Drilling Co., Inc.	1966	U	400	V	Oc	ls
547	3958-7641	York Shipley Inc.	do.	1966	U	385	V	Cl	---
560	3953-7635	Earl Leiphart	---	---	U	755	V	mg	sch
561	3952-7635	Richard Smith	---	---	U	880	W	was	sch
562	3952-7635	George Herbst	---	---	H	670	V	was	sch
563	3952-7634	Clayton Tyson	---	---	U	780	H	was	sch
564	3952-7632	William Daugherty	---	---	H	820	H	was	sch
565	3951-7630	S. H. Kilgore	---	---	U	770	W	was	sch
566	3949-7630	E. C. Martin	---	---	H	430	V	was	sch
567	3951-7628	F. P. Warner	---	---	U	760	W	was	sch
568	3950-7629	Arthur Thompson	---	---	U	740	H	was	sch
569	3951-7627	Robert Myers	---	---	U	780	H	was	sch
570	3948-7627	Robert Manifold	---	1919	U	605	H	was	sch
571	3948-7625	Emory Downs	---	---	U	655	H	was	sch
572	3949-7626	Desota Burchett	---	---	U	590	S	was	sch
573	3949-7624	Henry Reinecke	---	---	U	630	S	was	sch
574	3948-7623	J. S. Cadill	---	---	U	600	S	was	sch
575	3947-7624	Fawn Foods Inc.	---	---	H	530	S	was	sch
576	3947-7627	G. W. Throne	---	---	U	615	W	was	sch
577	3947-7627	do.	---	---	U	505	S	was	sch
578	3946-7628	Newton Strawbridge	---	---	H	640	S	was	sch
579	3947-7629	M. E. Cooper	---	---	U	435	S	was	sch
580	3945-7629	A. C. Jamison, Sr.	---	---	U	795	H	was	sch
581	3945-7626	B. H. Davis	---	---	U	640	W	was	sch
582	3946-7626	J. C. Fulton	---	---	H	425	H	was	sch
583	3945-7623	Everett Gemmill	---	---	U	580	S	was	sch
584	3945-7623	do.	---	---	U	560	S	was	sch
585	3947-7622	---	---	---	U	520	S	was	sch
586	3946-7618	Dwight Baugus	---	---	U	420	S	pc	sch
587	3946-7619	Earl Deshner	---	---	U	245	H	was	sch
588	3945-7622	---	---	---	H	290	V	was	sch
589	3944-7621	Mrs. Wise	---	---	U	420	S	pc	sch
590	3945-7632	Paul Webb	---	---	U	735	S	was	sch
591	3944-7632	W. S. McDonald	---	---	U	730	S	was	sch

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Pumping data			Hardness (gpg)	Specific conductance (micromhos at 25° C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured	Yield (gpm)	Drawdown (feet)	Time (hrs)				
75	10	6	---	35	5/69	2	5	C	4	200	5.6	Yo- 509
60	---	---	---	---	---	---	---	---	2	125	6.8	510
30	---	6	---	---	---	---	---	---	3	140	5.5	511
50	20	6	---	17	6/69	9	3	---	2	80	5.8	512
59	---	---	---	56	5/69	---	---	---	1	60	---	513
144	95	6	105	58	6/69	3	19	8	3	---	---	514
70	30	6	---	36	6/69	6	20	B	6	265	5.6	515
106	85	6	---	76	6/69	4	5	1	1	50	5.2	516
327	44	6	---	38	7/62	9	---	---	2	60	6.1	517
120	64	6	---	10	7/69	30	100	24	---	---	---	518
110	45	6	90	32	10/70	6	27	1	6	350	---	519
60	24	6	---	---	---	35	---	---	---	80	5.2	520
80	---	6	---	53	10/69	5	3	1	---	50	---	521
230	95	6	---	64	10/69	8	34	A	---	240	7.7	522
165	---	6	---	78	10/69	6	48	B	4	200	6.3	523
124	66	6	---	---	---	3	---	---	6	270	7.0	524
76	58	6	50; 76	---	---	10	---	---	2	85	---	525
95	65	6	---	---	---	10	---	---	---	---	---	526
50	25	6	---	5	10/69	28	11	2	3	175	5.5	527
48	25	---	---	5	6/70	60	11	1	6	280	---	528
65	---	6	---	---	---	---	---	---	2	80	5.0	529
85	25	6	---	53	10/69	3	22	B	2	115	5.4	530
120	---	6	---	---	---	7	---	---	2	80	5.7	531
95	15	6	---	52	11/69	5	---	1	2	70	5.3	532
62	10	6	---	---	---	---	---	---	2	105	5.3	533
140	40	6	---	61	10/69	7	10	2	3	120	---	534
140	30	6	80	23	11/69	5	96	B	2	90	5.0	535
50	---	6	---	---	---	---	---	---	1	50	---	536
50	28	6	---	---	---	30	---	---	---	---	---	537
90	53	6	---	23	5/70	5	6	1	3	120	---	538
44	30	6	---	19	5/70	5	1	1	2	105	---	539
122	---	6	---	35	5/70	3	3	1	3	185	---	540
115	25	6	---	---	---	30	---	---	---	---	---	541
87	15	6	---	---	---	---	---	---	---	---	---	542
102	30	6	---	40	5/70	5	50	B	4	280	---	543
76	30	6	---	---	---	---	---	---	---	---	---	544
85	30	6	---	---	---	25	---	---	---	---	---	545
127	---	8	38	20	9/66	64	---	13	18	700	7.0	546
18	15	10	---	6	9/66	65	6	24	16	600	7.0	547
13	---	48	---	9	1/71	---	---	---	---	175	---	560
29	---	60	---	22	4/68	---	---	---	---	---	---	561
30	---	6	---	10	4/68	---	---	---	2	95	---	562
43	---	36	---	16	4/68	13	4	1	---	240	---	563
60	30	6	---	40	4/68	---	---	---	1	60	---	564
20	---	60	---	15	4/68	---	---	---	---	---	---	565
13	---	36	---	6	4/68	---	---	---	---	510	---	566
29	---	48	---	24	4/68	---	---	---	---	100	---	567
58	---	60	---	51	4/68	---	---	---	3	200	---	568
125	---	6	---	48	4/68	---	---	---	---	---	---	569
80	---	6	---	50	4/68	---	---	---	---	---	---	570
46	---	48	---	44	4/68	---	---	---	---	---	---	571
34	---	60	---	31	4/68	---	---	---	---	---	---	572
27	---	6	---	16	4/68	---	---	---	---	---	---	573
47	---	60	---	39	4/68	---	---	---	---	50	---	574
105	---	6	---	32	4/68	---	---	---	3	170	---	575
115	12	6	---	33	1/71	---	---	---	---	---	---	576
37	---	36	---	32	4/68	---	---	---	---	220	---	577
33	---	60	---	30	4/68	---	---	---	1	75	---	578
32	---	6	---	15	4/68	2	17	B	---	70	---	579
125	---	60	---	69	4/68	---	---	---	---	---	---	580
31	---	60	---	22	4/68	---	---	---	---	110	---	581
28	---	36	---	20	4/68	---	---	---	2	145	---	582
38	---	6	---	11	4/68	---	---	---	---	---	---	583
31	---	6	---	15	4/68	---	---	---	---	---	---	584
62	---	6	---	44	4/68	---	---	---	1	25	---	585
45	---	6	---	43	4/68	---	---	---	---	---	---	586
36	---	6	---	18	4/68	---	---	---	4	240	---	587
35	---	6	---	5	4/68	---	---	---	1	60	---	588
41	---	4	---	34	4/68	---	---	---	---	---	---	589
15	---	---	---	11	11/68	---	---	---	---	75	---	590
39	---	---	---	34	11/68	---	---	---	---	75	---	591

TABLE 17.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer	
Number	Lat-Long							Name	Composition
Yo- 592	3944-7630	Mrs. Frank Caufield	---	---	U	700	S	was	sch
593	3943-7621	Frank Thomas	A. C. Reider & Son, Inc.	1952	U	480	S	pc	sch
594	3944-7625	C. E. Richardson	---	---	U	580	S	was	sch
595	3943-7625	do.	---	---	U	640	S	was	sch
596	3946-7631	Wiles Hurley	---	---	U	685	S	was	sch
597	3950-7634	Mrs. Michael Bowser	---	---	S	640	S	was	sch
598	3949-7632	Ivan Saylor	---	---	U	650	W	was	sch
599	3946-7634	John Marsteller	---	---	U	830	S	was	sch
600	3947-7634	C. A. C. Hyson	---	---	U	790	S	was	sch
601	3950-7651	R. E. Kern	William W. Reichart	1966	H	700	H	Єhp	---
602	3945-7641	Bor. of Railroad	A. C. Reider & Son, Inc.	1959	P	865	V	mbw	---
603	3948-7650	Bor. of Jefferson	---	1946	U	775	H	mg	sch
604	3951-7642	Bor. of Loganville	---	1955	P	750	S	mg	sch
605	3948-7649	Bor. of Jefferson	---	1952	U	730	S	mg	sch
606	3951-7642	Bor. of Loganville	---	1955	P	830	S	mg	sch
607	3948-7650	Russell Schroll	Young Bros.	1966	H	740	H	mg	sch
608	3951-7642	Bor. of Loganville	---	1964	P	670	W	mg	sch
609	3949-7649	William Brogan	Young Bros.	1967	H	700	S	mg	sch
610	3951-7642	Bor. of Loganville	---	1951	P	730	S	mg	sch
611	3948-7652	Robert Adams	Mummert & Sterner	1966	H	545	V	mg	sch
612	3952-7640	J. L. Myers	A. C. Reider & Son, Inc.	1960	H	570	H	wm	---
613	3948-7651	O. O. Walls	William W. Reichart	1966	H	580	S	mg	sch
614	3950-7639	L. T. Godfrey	A. C. Reider & Son, Inc.	1960	H	600	W	was	sch
615	3950-7652	P. C. Miller	---	---	H	595	V	Єhp	---
616	3947-7638	Daniel Ruth	---	---	H	925	S	was	sch
617	3950-7651	Glenn Zumbrum	---	---	H	630	V	Єhp	---
618	3949-7639	C. C. Sander	A. C. Reider & Son, Inc.	1968	H	800	H	was	sch
619	3949-7650	E. Gutman	Young Bros.	1967	H	625	S	Єa	---
620	3945-7641	Bor. of Railroad	---	---	U	820	H	mbw	sch
621	3948-7651	Gutman Bros. Farm	---	1960	H	618	S	Єa	---
622	3950-7636	Lloyd Trout	---	1958	H	825	S	was	sch
623	3949-7649	Harry Hoff	Mummert & Sterner	1966	H	590	S	Єa	---
624	3948-7636	John Evans	---	---	H	820	V	was	sch
625	3950-7648	Oscar Shaffer	Young Bros.	1966	H	515	V	Oc	ls
626	3949-7630	Edward Martin	---	---	H	430	V	was	sch
627	3949-7648	Daniel Shive	Young Bros.	1967	H	760	S	mg	sch
628	3945-7631	A. Commings	---	---	H	535	V	was	sch
629	3949-7648	Gordan Shive	Young Bros.	1967	H	775	H	mg	sch
630	3949-7627	Clair Stewart	---	---	H	655	S	was	sch
631	3950-7646	Preston Stine	Young Bros.	1962	U	480	V	Oc	ls
632	3945-7628	Eugene Scott	A. C. Reider & Son, Inc.	1964	H	690	S	was	sch
633	3951-7646	Seven Valleys Bor.	Young Bros.	1966	P	465	V	Oc	ls
634	3955-7628	Harold Douglas	---	1920	H	650	H	was	sch
635	3950-7645	Seven Valleys Bor.	---	---	U	620	S	mg	sch
636	3956-7629	Leon Arnold	A. C. Reider & Son, Inc.	1955	H	440	S	mg	sch
637	3951-7645	Seven Valleys Bor.	---	1942	U	655	H	mg	sch
638	3955-7633	Allen Bahn	A. C. Reider & Son, Inc.	1950	---	610	W	mg	sch
639	3951-7645	Seven Valleys Bor.	---	1942	U	---	H	mg	sch
640	3958-7631	Walter Stein	A. C. Reider & Son, Inc.	1966	H	490	H	Єa	metc
642	3959-7631	Lewis Brown	---	---	H	380	V	Єk	sh
644	3957-7637	Lloyd Fauth	---	---	H	635	S	Єhp	---
646	4000-7639	York Co. Parks & Recreation	A. C. Reider & Son, Inc.	1970	P	770	H	Єc	---
647	3957-7644	Columbia Gas Co.	---	---	U	405	V	Єk	ls
648	4000-7631	Charles McCleary	---	---	H	400	S	Єa	---
649	3956-7647	Raub Supply Co.	York Drilling Co., Inc.	1966	U	405	V	Єl	dol
650	3957-7634	Elizabeth Ball	---	---	H	695	H	Єc	---
651	3956-7647	Raub Supply Co.	York Drilling Co., Inc.	1966	U	415	V	Єl	dol
652	3956-7636	Clarence Kraft	---	1936	H	820	S	Єc	sch
653	3956-7646	Medusa Portland Cement Co.	---	---	---	---	S	Єl	dol
654	4000-7637	William Blymire	Paul E. Kohler	1969	H	400	V	Єv	dol
655	3955-7649	H. E. Crist	---	---	---	---	S	Єl	dol
656	4001-7636	Cora Ilgenfritz	A. C. Reider & Son, Inc.	1960	H	645	V	Єc	sch
657	3959-7643	AMF Inc.	York Drilling Co., Inc.	1966	U	370	V	Єv	dol
658	3959-7632	Doris Shenenberger	---	---	H	530	H	Єhp	---
659	3959-7643	AMF Inc.	York Drilling Co., Inc.	1966	U	370	V	Єv	dol
660	3956-7639	C. N. Snyder	A. C. Reider & Son, Inc.	1956	H	590	W	Єa	---
661	3951-7646	Paul Lau	Young Bros.	1966	H	590	S	Єa	---
662	4001-7637	Ted Kauffman	Paul E. Kohler	1970	H	820	H	Єc	---
663	3952-7645	C. V. Smith	Young Bros.	1966	H	682	S	Єhp	---
664	4002-7641	Emery Daugherty	---	---	H	525	S	Єa	---
665	3952-7646	W. R. Guise	Young Bros.	1967	H	600	W	Єhp	---
666	4000-7642	Stewart Snyder	A. C. Reider & Son, Inc.	1940	H	345	V	Єv	dol
667	3950-7645	Grover Boose	Young Bros.	1966	H	725	H	mg	sch

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Pumping data			Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25° C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured	Yield (gpm)	Draw-down (feet)	Time (hrs)				
39	---	---	---	37	11/68	---	---	---	---	80	---	Yo- 592
52	50	6	---	3	7/70	12	4	1	2	110	6.2	593
23	---	---	---	21	11/68	---	---	---	---	---	---	594
17	---	---	---	14	11/68	---	---	---	---	---	---	595
18	---	46	---	15	10/69	---	---	---	---	70	---	596
23	---	---	---	18	11/68	---	---	---	---	---	---	597
32	---	---	---	30	11/68	---	---	---	---	70	---	598
30	---	---	---	10	11/68	---	---	---	---	---	---	599
29	---	---	---	24	11/68	---	---	---	---	---	---	600
174	45	6	62;105;166	55	12/66	16	---	---	4	275	6.0	601
227	190	4	---	6	8/70	96	167	24	---	---	---	602
447	---	6	---	27	9/70	---	---	---	---	---	---	603
130	---	6	---	---	---	70	---	---	2	130	6.5	604
200	---	6	---	---	---	5	---	---	---	---	---	605
119	20	6	---	---	---	10	---	---	---	---	---	606
167	70	6	95	35	6/66	3	---	---	---	---	---	607
111	---	6	---	27	10/70	28	26	1	4	260	5.8	608
207	37	6	67	33	4/67	1	---	---	3	135	6.0	609
125	---	8	---	---	---	28	---	---	---	---	---	610
85	26	6	54; 70	18	8/66	12	---	---	3	140	6.0	611
125	50	6	---	41	10/70	4	2	1	7	350	7.0	612
150	22	6	21; 90;142	16	9/70	3	38	1	3	110	6.5	613
88	40	6	---	14	10/70	10	---	---	---	200	---	614
27	---	6	---	8	9/70	---	---	---	10	390	7.5	615
81	---	6	---	16	10/70	5	30	1	3	145	---	616
110	---	6	---	18	9/70	4	40	1	8	400	7.5	617
120	15	6	---	53	10/70	5	8	C	1	50	5.95	618
105	28	6	32; 85; 93	13	9/70	40	---	---	4	190	6.0	619
220	13	6	---	60	10/70	2	13	1	4	180	6.0	620
150	---	6	---	20	9/70	---	---	---	4	175	6.0	621
65	---	6	---	27	10/70	7	1	1	2	125	5.55	622
85	56	6	58; 73	25	9/66	12	---	---	1	60	5.5	623
58	---	6	---	8	10/70	5	2	8	4	190	---	624
135	19	6	118;129	12	7/66	30	---	---	15	590	7.0	625
147	---	6	---	29	10/70	6	51	8	4	250	---	626
86	50	6	48	31	6/67	10	12	1	3	140	6.0	627
71	---	6	---	53	10/70	1	5	1	3	160	6.4	628
205	50	6	55; 80	40	6/67	4	---	---	---	---	---	629
60	---	8	---	29	11/70	5	22	A	3	145	---	630
300	40	6	---	22	9/70	17	20	2	8	345	7.0	631
79	---	6	---	25	12/70	7	1	1	1	90	---	632
38	36	6	12; 27; 36	6	7/66	100	10	48	10	390	7.0	633
80	---	6	---	62	12/70	3	5	1	1	110	---	634
140	---	6	---	10	9/70	15	---	---	---	---	---	635
85	---	6	---	---	---	4	---	---	2	110	---	636
230	12	6	---	26	9/70	5	---	---	3	170	---	637
76	23	---	---	---	---	---	---	---	2	120	5.3	638
450	19	6	---	---	---	4	---	---	---	---	---	639
150	16	6	---	---	---	3	---	---	8	370	5.8	640
80	---	6	---	45	4/71	7	1	---	12	420	6.5	642
110	---	6	---	---	---	---	---	---	6	350	5.5	644
425	25	6	---	112	4/71	4	60	8	1	80	---	646
706	---	8	---	19	8/71	250	118	24	---	---	---	647
58	---	6	---	16	5/71	6	23	8	3	170	5.5	648
165	---	8	---	5	9/66	125	14	24	---	---	---	649
101	---	6	---	---	---	---	---	---	2	90	5.3	650
300	---	8	---	5	9/66	19	265	7	---	---	---	651
158	40	6	---	69	5/71	8	35	A	1	50	5.0	652
300	---	8	---	---	---	100	---	---	---	---	---	653
35	---	---	---	---	---	---	---	---	7	360	6.0	654
48	---	6	---	---	---	3	---	---	---	---	---	655
70	---	6	---	---	---	10	---	---	2	70	5.3	656
65	---	8	---	23	7/71	40	2	1	10	410	7.0	657
100	---	---	---	---	---	---	---	---	2	150	5.5	658
62	---	8	---	4	7/71	---	---	---	---	---	---	659
63	---	6	---	---	---	2	---	---	4	270	5.5	660
248	23	6	35;152	100	6/66	3	---	---	7	300	6.5	661
120	44	6	---	---	---	3	---	---	4	230	5.3	662
170	19	6	30; 58	52	11/66	1	---	---	4	220	6.0	663
85	---	6	---	40	7/71	7	32	A	4	220	6.0	664
127	21	6	38;115	15	9/70	10	16	1	3	155	6.0	665
133	30	6	---	17	5/71	6	9	1	14	700	6.8	666
150	19	6	78; 95	46	10/66	4	---	---	4	210	6.0	667

TABLE 17.

Well location						Alti- tude of land surface (feet)	Topo- graphic setting	Aquifer	
Number	Lat-Long	Owner	Oriller	Oate completed	Use			Name	Compo- sition
Yo- 668	4001-7632	Mrs. F. A. 8rown	---	1947	H	320	5	Oc	ls
669	3951-7646	Theodore Lau	Young 8ros.	1966	H	485	V	Oc	ls
670	3959-7637	R. 5. Welsh	---	1950	H	420	S	€k	ls
671	3950-7646	8radley Kopp	Young 8ros.	1967	H	470	V	Oc	ls
672	3958-7637	Millard Hoke	Paul E. Kohler	1967	H	510	V	€c	sch
673	3949-7647	Norman Rohrbaugh	Young 8ros.	1967	H	615	5	mg	sch
674	3956-7639	Russel 5echrist	Paul E. Kohler	1969	U	635	S	€hp	---
675	3949-7647	R. 5. Miller	Young Bros.	1967	H	620	S	mg	sch
676	3959-7637	5. H. 5hipley	---	1960	H	360	V	€k	ls
677	3949-7647	R. L. Fisher	Young Bros.	1967	H	630	S	mg	sch
678	3953-7640	C. H. Torbert	A. C. Reider & 5on, Inc.	1953	H	740	H	mg	sch
679	3949-7647	0. E. Baldwin	Young 8ros.	1966	H	630	5	mg	sch
680	3955-7643	Oale Markey	do.	1953	H	640	5	€hp	---
681	3949-7647	G. Krebs	do.	1966	H	610	V	mg	sch
682	4001-7636	Glen Geiselman	---	1950	H	640	5	€c	---
683	3949-7647	Oavid Brodbeck	Young 8ros.	1966	H	750	H	mg	sch
6B4	3959-7635	Robert Flaharty	---	1958	H	670	H	€c	sch
6B5	3949-7643	Richard Reichart	Young 8ros.	1966	H	B03	H	mg	sch
686	3948-7658	Ooubleday and Co. Inc.	Harrisburg's Kohl Bros.	---	N	605	H	Oc	ls
687	3949-7645	Carroll Rohrbaugh	A. C. Reider & 5on, Inc.	1966	H	630	V	mg	sch
688	3955-7646	Paul Gilbert	---	1930	H	510	5	Oc	ls
689	3948-7646	W. G. Krebs	Young Bros.	1968	U	775	S	mg	sch
690	3959-7632	5am Lewis State Park	A. C. Reider & 5on, Inc.	1956	P	840	H	€c	---
691	3950-7646	Richard 5hadle	Young 8ros.	1970	H	645	5	mg	sch
692	3957-7631	East Prospect Bor.	Paul E. Kohler	1954	P	350	V	Oc	ls
693	3955-7653	George Thomas	Young Bros.	1967	H	4B2	V	€v	dol
694	3957-7631	East Prospect 8or.	York Orilling Co., Inc.	1967	U	350	V	Oc	ls
695	3948-7647	E. W. Towman	Mummert & Sterner	1955	5	760	5	mg	sch
696	3954-7634	Windsor 8or.	A. C. Reider & 5on, Inc.	1950	U	690	W	mg	sch
697	3947-7648	W. R. Krebs	Mummert & 5terner	1957	H	915	5	mg	sch
698	3959-7630	Lauxmont Farms	---	---	H	420	H	€a	---
699	3945-7648	Vernon Masimore	A. C. Reider & 5on, Inc.	1970	H	840	5	was	sch
700	3959-7630	Lauxmont Farms	Paul E. Kohler	---	H	595	5	€hp	---
701	3946-7648	Vernon Masimore	A. C. Reider & 5on, Inc.	1970	H	825	5	was	sch
702	4002-7632	Wrightsville Water Co.	Harrisburg's Kohl Bros.	1947	U	370	H	Oc	ls
703	3945-7651	Vernon Masimore	A. C. Reider & 5on, Inc.	1970	H	8B0	5	mg	sch
704	4002-7632	Wrightsville Water Co.	---	---	U	370	H	Oc	ls
705	3945-7651	Vernon Masimore	A. C. Reider & Son, Inc.	1970	H	865	S	mg	sch
706	395B-7635	Oennis Lever	---	---	H	625	5	€c	---
707	3945-7651	Vernon Masimore	A. C. Reider & 5on, Inc.	1970	H	840	5	mg	sch
708	3958-7636	P. J. 8inder	---	---	U	690	H	€c	---
709	3945-7651	Vernon Masimore	A. C. Reider & 5on, Inc.	1970	H	B30	5	mg	sch
710	3956-7631	Lauxmont Farms	---	---	H	610	5	mg	sch
711	3947-7647	J. Johnson	Young Bros.	1970	H	925	H	mg	sch
712	3958-7633	James Cunningham	---	1966	H	530	H	€a	---
713	3945-764B	Charles Trump	A. C. Reider & 5on, Inc.	1970	H	720	5	mg	sch
714	3957-7635	Roy Holsinger	James P. Kohler	1967	H	545	S	€a	---
715	3946-7649	5tiffler	Mummert & Sterner	1953	H	650	V	mg	sch
716	3946-7644	5usquehannock High 5ch.	A. C. Reider & 5on, Inc.	1952	T	775	H	mbw	---
717	3945-7650	William Kurtz	Mummert & 5terner	1966	H	830	5	mg	sch
718	3957-7637	Locust Grove Elem. Sch.	A. C. Reider & 5on, Inc.	1957	U	630	H	€hp	---
719	3945-7650	Oavid Krutz	Mummert & 5terner	1967	H	990	H	mg	sch
720	3955-7631	C. E. Kinkel	A. C. Reider & Son, Inc.	1964	5	690	H	mg	sch
721	3947-7652	Paul Kaltreider	Mummert & 5terner	1964	H	770	H	mg	sch
722	3956-7634	John Luxton	---	1946	H	735	H	€c	---
723	3947-7648	Codorus Twp.	A. C. Reider & 5on, Inc.	1970	H	890	S	mg	sch
724	3956-7636	George Rittenhouse	do.	1967	H	780	5	€c	---
725	3956-7649	J. E. 8aker Co.	do.	1955	H	445	V	€l	dol
726	3956-7646	Medusa Portland Cement Co.	Harrisburg's Kohl Bros.	1961	N	395	S	€l	dol
727	3956-7646	do.	do.	1961	U	395	5	€l	dol
728	3947-7655	Pa. Oept. Forests and Waters	do.	1970	P	690	W	€hp	---
729	3957-7642	Glen Gary 5hale Brick Corp.	do.	1954	U	445	5	Oc	ls
759	3949-7646	AMP Inc.	do.	1957	H	525	V	mg	sch
760	3954-7636	Clyde Reale	A. C. Reider & 5on, Inc.	1966	H	845	5	mg	sch
761	3955-7651	G. E. Akins	---	1947	H	460	V	Cv	dol
762	4001-7633	Jay Bair	A. C. Reider & 5on, Inc.	1965	H	475	5	€hp	---
763	3955-7652	G. E. Akins	Mummert & 5terner	1953	H	515	5	€k	shl
764	3947-7655	Codorus 5tate Park	Harrisburg's Kohl 8ros.	1970	H	640	W	Chp	---
765	3955-7651	Paul Miller	---	1930	U	450	V	€k	ls
766	3947-7654	Codorus 5tate Park	Harrisburg's Kohl 8ros.	1970	H	665	H	€hp	---

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Pumping data			Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25° C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured	Yield (gpm)	Draw-down (feet)	Time (hrs)				
145	---	6	---	---	---	---	---	---	12	650	6.8	Yo- 668
90	89	6	41; 87	20	11/66	20	---	---	---	---	---	669
75	15	6	---	36	5/71	6	15	1	9	550	---	670
208	17	6	24; 30	9	9/70	2	---	---	7	550	7.0	671
240	20	6	---	---	---	2	---	---	4	190	5.8	672
310	30	6	135	30	7/67	1	---	---	4	155	6.0	673
215	---	6	---	40	4/71	4	98	C	6	245	6.3	674
207	51	6	51	16	1/67	1	---	---	---	---	---	675
40	---	6	---	---	---	---	---	---	20	850	6.5	676
310	38	6	51	17	1/67	1	---	---	---	---	---	677
75	---	6	---	38	5/71	6	23	1	4	200	5.5	678
292	22	6	67	20	6/66	1	---	---	---	---	---	679
70	30	6	---	26	6/71	5	18	1	7	360	5.3	680
127	22	6	52; 87	---	---	3	---	---	4	180	6.5	681
120	20	6	---	---	---	2	---	---	---	---	---	682
147	30	6	41;107	34	9/70	3	---	---	5	355	6.5	683
170	25	6	---	---	---	3	---	---	3	120	5.3	684
103	20	6	62; 78; 92	29	9/70	4	25	1	4	245	6.0	685
462	---	8	---	25	9/46	220	176	24	---	---	---	686
140	19	6	---	---	---	1	---	---	---	---	---	687
75	10	6	---	32	5/71	5	26	8	15	600	6.8	688
206	---	6	---	18	10/70	1	---	---	2	100	6.0	689
90	40	6	---	30	12/56	18	30	3	---	---	---	690
167	46	6	78	26	10/70	3	69	1	3	100	6.0	691
275	19	6	---	---	---	---	---	---	---	---	---	692
184	30	6	54;147	17	10/70	3	79	1	11	400	7.0	693
255	24	8	230	6	10/67	100	190	12	---	---	---	694
86	27	6	---	24	10/70	13	---	---	5	240	6.0	695
220	20	8	---	7	6/71	4	117	8	2	80	6.0	696
90	45	6	---	32	10/70	---	---	---	3	190	6.0	697
55	20	6	---	33	5/71	8	8	1	3	190	6.0	698
132	114	6	---	73	10/70	7	7	2	1	50	6.0	699
150	75	6	---	51	5/71	13	11	A	6	290	6.5	700
125	45	6	---	62	10/70	2	1	1	1	50	6.0	701
425	34	6	---	30	12/47	25	95	24	---	---	---	702
122	34	6	---	40	10/70	10	15	1	2	100	6.0	703
430	33	6	---	22	1/49	20	58	5	---	---	---	704
115	14	6	---	46	10/70	11	5	C	2	100	5.5	705
38	---	6	---	28	5/71	7	1	1	2	190	5.5	706
101	44	6	---	30	10/70	4	11	1	2	100	6.0	707
205	80	8	---	60	3/60	22	100	9	---	---	---	708
89	34	6	---	27	10/70	10	---	---	---	80	5.5	709
150	80	6	---	10	5/71	13	9	1	2	75	5.5	710
102	---	6	---	45	10/70	---	---	---	1	50	5.0	711
91	---	6	---	48	6/71	4	7	1	6	430	6.0	712
255	20	6	---	38	10/70	5	20	1	4	175	6.0	713
215	20	6	---	28	6/71	10	61	8	3	190	5.5	714
70	30	6	---	10	9/53	4	---	---	3	135	6.0	715
408	176	8	---	35	1/52	150	119	24	---	---	---	716
80	21	6	56; 69	40	8/66	9	---	---	2	85	5.5	717
200	66	6	---	30	7/57	12	130	24	---	---	---	718
140	35	6	93	50	9/67	3	---	---	1	25	5.0	719
110	---	6	---	43	7/71	9	10	1	3	145	5.5	720
140	---	6	---	38	11/70	2	---	---	3	130	---	721
165	---	6	---	35	6/71	8	30	A	6	420	5.5	722
90	40	6	65	52	11/70	7	3	1	1	50	5.5	723
400	87	6	---	---	---	2	---	---	5	200	6.3	724
270	---	6	---	15	12/66	120	170	18	18	650	7.0	725
252	---	8	---	22	11/61	400	80	14	19	790	7.0	726
298	---	10	---	15	11/61	800	67	14	---	---	---	727
200	45	6	---	21	4/71	29	34	7	---	---	---	728
742	23	8	---	10	5/71	40	287	13	17	680	7.0	729
200	---	6	---	12	3/57	15	150	2	---	---	---	759
67	36	6	---	---	---	10	---	---	4	230	6.0	760
220	---	6	---	77	7/71	2	18	1	17	695	7.8	761
95	---	6	---	23	6/71	7	6	1	2	120	5.7	762
135	18	6	---	82	7/71	3	---	---	11	450	7.5	763
150	28	6	30; 50; 65	20	4/71	13	106	48	---	---	---	764
18	---	6	---	16	7/71	---	---	---	13	640	---	765
160	50	6	---	45	4/71	13	65	25	---	---	---	766

TABLE 17.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer	
Number	Lat-Long							Name	Composition
Yo- 767	3954-7649	Marvin Broadwater	---	---	H	480	S	Ꞓk	ls
768	3947-7655	Codorus State Park	Harrisburg's Kohl Bros.	1971	H	650	W	mg	sch
769	3955-7648	C. H. Becker	----	---	H	445	S	Ꞓk	ls
770	4002-7637	Martin Kondor	A. C. Reider & Son, Inc.	1955	H	765	S	Ꞓc	---
771	3954-7645	United Urban Ministry Day Camp	Young Bros.	1967	H	480	S	Ꞓhp	---
772	4002-7632	Michael Loucks	---	1935	H	630	S	Ꞓc	---
773	3955-7651	Thomasville Stone and Lime Co.	---	1965	H	475	D	Ꞓk	ls
774	4002-7637	Martin Kondon	A. C. Reider & Son, Inc.	1955	H	775	H	Ꞓc	---
775	3955-7651	Thomasville Stone and Lime Co.	---	1951	U	505	S	Ꞓk	ls
776	4001-7635	B. F. Bailey	Paul E. Kohler	1945	H	490	W	Ꞓc	---
777	3955-7651	Thomasville Stone and Lime Co.	---	---	U	490	S	Ꞓk	ls
778	3957-7639	Alfred Horne	---	---	H	640	S	Ꞓc	---
779	3954-7651	Gerald Rebrt	A. C. Reider & Son, Inc.	1966	H	500	S	Ꞓv	dol
780	3955-7640	Eli Williams	do.	1955	H	590	S	Ꞓa	---
781	3954-7652	Robert Hoover	---	---	U	495	S	Ꞓv	dol
782	3956-7640	Eli Williams	A. C. Reider & Son, Inc.	1964	H	525	W	Ꞓa	---
783	3954-7651	Dale Hoke	York Drilling Co., Inc.	1963	H	520	W	Ꞓk	ls
784	3954-7641	Murray Lehman	A. C. Reider & Son, Inc.	1959	H	685	H	Ꞓhp	---
785	3954-7652	J. L. Miller	---	---	H	482	S	Ꞓv	dol
786	4001-7641	Springettsbury Twp.	James P. Kohler	1970	U	335	V	Ꞓv	dol
787	3954-7651	C. J. Meyers	---	---	H	502	S	Ꞓk	ls
788	4002-7640	Eldon Martin	A. C. Reider & Son, Inc.	1956	H	440	S	Ꞓhp	---
789	3955-7650	Curvin Shellenberger	---	---	H	522	S	Ꞓk	ls
790	3952-7643	Richard Geiselman	---	1953	H	550	S	mg	sch
791	3955-7651	Curvin Shellenberger	Young Bros.	1966	H	515	S	Ꞓk	ls
792	4001-7639	York Rifle Range Assoc.	York Drilling Co., Inc.	1964	H	685	H	Ꞓc	---
793	3955-7650	Jacob Lehman	---	---	H	508	H	Ꞓk	ls
794	4003-7641	Mohr Orchards	A. C. Reider & Son, Inc.	1950	H	450	S	Ꞓa	---
795	3955-7650	J. E. Baker Co.	---	---	U	508	S	Ꞓk	ls
796	3953-7637	Clyde Wagner	---	1942	H	795	S	mg	sch
797	3955-7650	Robert Eisenhart	---	---	H	527	S	Ꞓk	ls
798	3953-7641	Donald Flinchbaugh	W. A. Sprenkle	1958	H	640	S	Ꞓhp	---
799	3955-7650	Ralph Weikert	---	---	H	495	S	Ꞓk	ls
800	3957-7646	Alvin Sultner	York Drilling Co., Inc.	---	H	405	V	Ꞓk	ls
801	3955-7651	George Grove	---	---	H	462	S	Ꞓk	ls
802	3955-7641	C. E. Snyder	York Drilling Co., Inc.	1963	H	595	V	Ꞓc	---
803	3955-7652	Irvin Hostetter	Young Bros.	1966	H	490	S	Ꞓv	dol
804	4000-7644	William Aldinger	---	1900	H	418	S	Ꞓv	dol
805	3947-7655	Codorus State Park	Joe Cekovich	1971	U	670	S	Ꞓhp	---
806	3947-7655	do.	do.	1971	U	635	W	Ꞓhp	---
807	3947-7655	do.	do.	1971	U	630	S	Ꞓhp	---
808	3947-7655	do.	do.	1971	H	645	W	Ꞓhp	---
809	3947-7654	do.	do.	1971	H	625	W	mg	sch
810	3946-7655	do.	do.	1971	U	630	W	mg	sch
811	3946-7655	do.	do.	1971	H	650	S	mg	sch
812	3947-7654	do.	do.	1971	U	635	S	Ꞓhp	---
813	3947-7654	do.	do.	1971	H	650	S	Ꞓhp	---
814	3947-7654	do.	do.	1971	H	635	S	Ꞓhp	---
815	3946-7644	Susquehannock High Sch.	A. C. Reider & Son, Inc.	1971	U	770	H	was	sch

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Pumping data			Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25° C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured	Yield (gpm)	Draw-down (feet)	Time (hrs)				
65	---	6	---	51	7/71	5	8	1	9	395	7.0	Yo- 767
180	23	6	15; 30;105	20	5/71	18	98	26	---	---	---	768
135	---	6	---	31	7/71	5	46	8	10	455	7.5	769
90	80	6	---	67	6/71	7	20	8	---	---	---	770
207	29	6	27; 58	41	6/67	7	66	1	2	140	6.0	771
145	---	6	---	46	6/71	5	3	8	2	90	5.5	772
173	40	6	---	110	7/71	6	30	A	11	425	7.5	773
120	80	6	---	---	---	---	---	---	---	---	---	774
200	70	6	---	168	7/71	1	---	---	14	520	7.0	775
73	---	6	---	14	7/71	7	5	8	1	70	5.5	776
156	---	6	---	90	7/71	---	---	---	---	---	---	777
43	---	42	---	30	7/71	2	1	1	3	245	5.5	778
140	10	6	54	85	7/71	15	---	---	7	295	7.0	779
180	30	6	---	50	7/71	9	49	A	---	180	6.0	780
80	---	6	---	56	7/71	---	---	---	---	---	---	781
85	20	6	---	17	7/71	---	---	---	---	---	---	782
95	85	6	---	40	7/71	100	---	---	9	405	7.3	783
65	20	6	---	---	---	7	---	---	---	---	---	784
75	---	6	---	50	7/71	---	---	---	---	---	---	785
400	60	6	---	13	7/71	5	98	C	4	300	6.8	786
12	---	48	---	7	7/71	---	---	---	11	500	7.5	787
112	12	6	---	44	7/71	4	10	1	6	255	7.0	788
125	---	6	---	42	7/71	---	---	---	8	325	7.0	789
84	---	6	---	23	7/71	5	33	1	2	120	5.5	790
292	32	6	---	95	7/71	2	---	---	12	450	7.0	791
170	26	6	---	91	7/71	10	40	A	1	50	5.5	792
28	28	50	---	20	7/71	---	---	---	16	750	7.5	793
319	30	6	---	110	7/71	14	15	2	2	80	5.7	794
128	---	6	---	118	7/71	---	---	---	---	---	---	795
85	13	6	---	---	---	---	---	---	4	130	6.0	796
220	---	6	---	68	7/71	---	---	---	10	510	7.0	797
66	40	6	---	30	7/71	7	6	8	6	400	6.0	798
70	---	6	---	---	7/71	---	---	---	---	---	---	799
52	---	6	---	13	7/71	10	1	1	14	640	7.0	800
---	---	6	---	36	7/71	---	---	---	---	---	---	801
122	25	6	29; 54	6	7/71	9	70	0	5	280	6.0	802
77	22	6	60	17	7/71	10	---	---	---	---	---	803
50	---	48	---	25	7/71	---	---	---	9	365	7.0	804
150	45	6	55	---	---	1	---	---	---	---	---	805
100	---	6	35	---	---	3	---	---	---	---	---	806
100	---	6	65	---	---	1	---	---	---	---	---	807
115	45	6	83	21	9/71	15	60	24	---	---	---	808
200	30	6	35; 85;160	10	9/71	20	122	24	---	---	---	809
150	---	6	30	---	---	1	---	---	---	---	---	810
175	21	6	21; 62; 80	10	9/71	5	139	24	---	---	---	811
125	19	10	15	4	8/71	15	---	---	---	---	---	812
150	27	6	27; 90;125	22	9/71	30	108	24	---	---	---	813
125	55	6	15; 58; 68	29	9/71	60	30	24	---	---	---	814
420	80	6	90;180;340	32	3/71	12	---	---	---	---	---	815

TABLE 18. CHEMICAL

Well number	Date of collection	Aquifer	Dominant rock type	Silica (SiO_2)	Total iron (Fe)	Total manganese (Mn)	Chromium (Cr)	Cadmium (Cd)	Lead (Pb)	Zinc (Zn)	Copper (Cu)
											ADAMS
Ad-182	5-20-69	Antietam Fm.	Quartzite	14	0.55	0.07	----	----	----	----	----
185	5-13-69	Kinzers Fm.	Limestone	7.1	.03	.00	----	----	----	----	----
189	5-15-69	do.	do.	11	.04	.01	----	----	----	----	----
199	5-29-69	Conestoga Fm.	do.	8.9	1.6	.08	----	----	----	----	----
212	8-29-69	Harpers Fm.	Phyllite	7.8	.25	.00	----	----	----	----	----
224	9-18-69	Marburg Schist	Schist	8.1	.28	.10	----	----	----	----	----
											YORK
Yo- 10	4-29-71	Harpers Fm.	Phyllite	13	.01	.29	----	----	----	----	----
226	3-15-69	Wissahickon Fm.	Schist	17	.04	.00	----	----	----	----	----
227	3-15-68	do.	do.	9.6	.14	.33	----	----	----	----	----
229	3-15-68	do.	do.	15	.06	.00	----	----	----	----	----
231	3-15-68	do.	do.	20	.10	.01	----	----	----	----	----
232	3-15-68	do.	do.	18	.08	.01	----	----	----	----	----
233	3-15-68	do.	do.	13	.08	.00	----	----	----	----	----
239	12- 8-70	Peach Bottom Slate	Slate	5.5	.11	.00	----	----	----	----	----
241	3-22-68	Conestoga Fm.	Limestone	9.2	.00	.00	----	----	0.02	0.00	0.00
242[a]	11-14-63	Ledger Fm.	Dolomite	----	.70	0	----	----	----	----	----
248	12- 3-70	Wissahickon Fm.	Schist	8.9	.00	.01	----	----	----	----	----
260	4-26-71	Harpers Fm.	Phyllite	15	1.2	.06	0.00	----	.00	.03	----
270	10-23-69	Marburg Schist	Schist	11	----	----	----	----	----	----	----
271	10-29-69	do.	do.	14	.05	.02	----	----	----	----	----
294	6-12-70	Conestoga Fm.	Limestone	10	.05	.01	----	----	.00	.33	.0
338	4-26-71	do.	do.	12	.07	.01	.00	0.00	.00	.14	----
357	4-27-71	Vintage Fm.	Dolomite	8.9	.15	.01	----	----	----	----	----
361	4-26-71	Ledger Fm.	Dolomite	9.8	.15	.15	----	----	----	----	----
367	4-26-71	Harpers Fm.	Phyllite	13	.07	.04	----	----	----	----	----
402	12- 1-70	Wissahickon Fm.	Metabasalt	13	.14	.01	----	----	----	----	----
419	12- 3-70	do.	Schist	9.9	.01	.02	----	----	----	----	----
422	12- 2-70	do.	do.	4.4	.05	.01	----	----	----	----	----
424	12- 1-70	do.	do.	2.5	1.6	.35	----	----	----	----	----
436	12- 1-70	do.	do.	8.9	.42	.02	----	----	----	----	---
442	12- 2-70	do.	do.	9.2	.11	----	----	----	----	----	---
463	12- 2-70	do.	do.	4.9	.10	.95	----	----	----	----	---
472	6-12-70	do.	do.	15	1.1	.05	----	----	.00	.00	.0
473	6-11-70	do.	do.	14	.25	.01	----	----	----	----	---
487	6- 4-70	do.	do.	8.0	.08	.50	----	----	----	----	---
491	4-23-71	Conestoga Fm.	Limestone	10	.49	.01	.01	.00	.00	.14	---
503	6-18-69	Peach Bottom Slate	Slate	6.8	.70	.09	----	----	.04	.17	.0
506	5- 7-69	Wissahickon Fm.	Schist	8.1	.04	.01	----	----	.02	.03	.0
509	5-22-69	Peters Creek Schist	Schist	7.0	3.4	.09	----	----	----	----	---
512	6-18-69	do.	do.	14	2.9	.02	----	----	----	----	---
515	6-16-69	do.	do.	14	----	----	----	----	----	----	---
516	6-17-69	do.	do.	14	1.1	.02	----	----	----	----	---
519	10- 6-69	Wissahickon Fm.	Schist	13	.62	.03	----	----	----	----	---
521	10- 8-69	do.	do.	6.7	.05	.21	----	----	----	----	---
523	10-16-69	do.	do.	12	.24	.01	----	----	----	----	---
534	10-29-69	do.	do.	10	.43	.06	----	----	----	----	---
538	12- 2-70	do.	do.	7.1	.06	.02	----	----	----	----	---
563	1-14-69	do.	do.	3.6	.05	.01	----	----	.03	.35	.
593	12- 2-70	Peters Creek Schist	Schist	13	0.23	0.03	----	----	----	----	---
596	3-11-69	Wissahickon Fm.	do.	6.2	----	----	----	----	----	----	---
	7-15-70	do.	do.	6.5	.03	.04	----	----	.00	.01	.
	7-24-69	do.	do.	4.9	----	----	----	----	----	----	---

ANALYSES OF GROUND WATER

Nickel (Ni)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Phosphate (PO_4)	Sum of dissolved constituents	Hardness as $CaCO_3$		Well number
												Calcium, magnesium	Non-carbonate	
COUNTY														
----	24	9.0	4.2	2.0	88	25	6.9	3.4	0.0	----	132	97	25	Ad-182
----	100	42	44	2.0	394	13	122	20	.0	----	544	422	99	185
----	52	17	21	1.1	211	31	32	12	.0	----	282	200	0	189
----	38	9.4	3.8	1.8	124	8.1	9.0	40	.1	----	180	134	32	199
----	8.6	4.8	12	1.2	18	3.9	26	12	.2	----	85	41	26	212
----	3.6	3.2	1.3	.2	34	1.1	1.6	.1	.2	----	36	22	0	224
COUNTY														
----	35	15	23	2.2	110	45	37	9.5	.1	0.02	234	149	59	Yo- 10
----	48	11	6.6	1.2	133	23	22	34	.0	----	228	165	56	226
----	13	7.1	16	1.6	20	4.9	20	66	.0	----	148	62	45	227
----	28	6.3	6.0	1.1	63	5.9	15	48	.0	----	156	96	45	229
----	18	5.2	3.4	1.1	48	6.5	9.5	22	.0	----	109	67	27	231
----	13	4.3	3.2	.3	36	2.7	5.5	21	.0	----	86	50	21	232
----	22	2.5	2.5	.9	76	2.2	3.7	9.7	.0	----	94	66	3	233
----	1.8	1.5	2.5	.5	8	.6	3.3	8.0	.1	.00	24	11	4	239
0.03	41	10	4.0	3.2	87	37	8.9	35	.0	.0	191	144	72	241
----	48.8	25.9	----	----	300	44	7.4	1.33	0	----	---	---	---	242
----	2.8	1.0	2.0	.4	13	.0	.8	7.8	.0	.02	30	11	---	248
.00	33	7.8	10	1.6	98	37	15	1.3	.1	.02	169	115	34	260
----	21	4.6	3.9	.8	67	6.8	5.8	20	.0	----	107	72	17	270
----	15	2.7	4.4	.5	46	3.5	6.9	14	.0	----	84	49	11	271
.00	90	9.2	6.4	1.7	233	39	14	39	.1	.00	324	263	72	294
----	92	11	6.4	1.2	264	25	15	14	.1	.01	307	275	58	338
----	86	25	18	1.1	252	37	63	8.5	.1	.01	372	318	111	357
----	74	15	5.6	3.9	241	54	20	.9	.1	.00	302	246	48	361
----	6.9	2.3	5.7	.9	15	8.1	7.4	5.0	.1	.03	57	27	16	367
----	22	4.0	2.3	.5	66	2.8	5.4	9.6	.0	.01	96	72	18	402
----	7.2	3.0	3.4	.8	12	1.2	8.0	28	.0	.00	68	33	23	419
----	10	7.0	2.8	1.2	6	9.2	13	34	.0	.01	85	54	49	422
----	12	9.6	8.5	16	55	8.2	22	34	.0	.00	140	70	25	424
----	8.2	3.7	4.5	1.0	10	1.8	5.9	39	.0	.00	69	36	28	436
----	8.0	2.5	8.7	1.7	12	5.0	15	19	.0	.02	75	31	21	442
----	21	16	30	41	33	37	76	90	.0	.08	332	119	92	463
.00	9.0	2.6	4.5	1.9	26	4.1	3.8	20	.1	.01	73	33	12	472
----	5.6	1.8	4.2	.8	15	.2	3.7	19	.1	.04	57	22	9	473
----	9.0	12	12	3.3	5	1.1	18	94	.1	.01	160	72	68	487
----	114	13	10	4.6	122	75	13	58	.3	.03	---	323	223	491
.03	9.0	2.5	5.8	.8	14	1.8	8.2	34	.0	.2	76	33	22	503
.01	9.0	7.0	6.8	1.3	15	33	17	42	.0	.0	102	52	39	506
----	12	6.0	9.5	2.2	9	9.0	14	55	.0	.0	119	55	47	509
----	8.5	1.9	3.9	.8	26	6.4	3.3	6.2	.0	.0	57	29	8	512
----	26	9.5	6.8	1.4	71	3.7	23	33	.0	.2	152	104	46	515
----	1.7	2.0	2.4	.9	5	.7	3.8	12	.0	.1	40	12	8	516
----	30	6.5	16	2.3	42	6.8	22	92	.2	----	210	102	67	519
----	1.7	1.2	2.9	.9	7	.4	3.9	9.1	.1	----	30	9	5	521
----	13	5.8	13	.5	32	.7	19	44	.0	----	124	57	31	523
----	12	2.5	3.1	.5	31	1.5	4.0	21	.1	----	70	41	15	534
----	7.6	4.5	3.5	1.8	10	.2	7.4	40	.0	.00	77	38	30	538
.00	18	8.5	4.2	3.2	31	29	11	33	.0	.0	130	80	56	563
----	7.6	2.5	4.4	1.2	17	5.3	5.3	22	.0	.01	70	30	16	593
----	14	6.0	5.2	16	24	14	16	44	.0	1.0	133	60	40	596
.00	13	6.0	4.5	7.8	18	7.1	17	43	.0	----	114	57	42	
----	6.2	3.5	3.2	7.2	11	4.4	10	28	.2	.00	73	30	21	

TABLE 18.

Well number	Date of collection	Aquifer	Dominant rock type	Silica (SiO_2)	Total iron (Fe)	Total manganese (Mn)	Chromium (Cr)	Cadmium (Cd)	Lead (Pb)	Zinc (Zn)	Copper (Cu)
Yo-596	11- 4-70	Wissahickon Fm.	Schist	5.3	----	----	----	----	----	----	----
	10-30-69	do.	do.	5.8	----	----	----	----	----	----	----
608	12- 1-70	Marburg Schist	Schist	12	.09	.01	----	----	----	----	----
612	10- 9-70	Wakefield Marble	Marble	7.8	.15	.02	----	----	.03	.02	.02
618	12- 1-70	Wissahickon Fm.	Schist	5.8	.01	.00	----	----	----	----	----
622	12- 2-70	do.	do.	5.6	.01	.00	----	----	----	----	----
626	12- 1-70	do.	do.	9.3	.01	----	----	----	----	----	----
628	12- 1-70	do.	do.	15	.03	.06	----	----	----	----	----
633	4-26-71	Conestoga Fm.	Limestone	10	.39	.01	.00	.00	.00	.02	----
634	12-10-70	Wissahickon Fm.	Schist	8.3	.13	.04	----	----	----	----	----
636	12-10-70	Marburg Schist	Schist	8.1	.06	.02	----	----	----	----	----
638	4-12-71	do.	do.	6.1	.17	.02	.00	.00	.00	.01	----
640	4-12-71	Antietam Fm.	Quartzite	17	.02	.03	----	----	----	----	----
642	4-12-71	Kinzers Fm.	Shale	12	.40	.01	----	----	----	----	----
644	4-12-71	Harpers Fm.	Phyllite	8.6	.10	.29	.00	.00	.00	.26	----
646	4- 2-71	Chickies Fm.	Quartzite	11	.28	.06	----	----	----	----	----
648	4-15-71	Antietam Fm.	do.	16	.21	.03	----	----	----	----	----
650	4-15-71	Chickies Fm.	do.	6.8	.26	.03	----	----	----	----	----
652	4-15-71	do.	Slate	5.6	.12	.01	----	----	----	----	----
654	4-15-71	Vintage Fm.	Dolomite	6.1	.03	.00	----	----	----	----	----
656	4-15-71	Chickies Fm.	Quartzite	7.7	.31	.04	----	----	----	----	----
658	4-20-71	Harpers Fm.	Phyllite	19	.06	.00	.00	.00	.00	.02	----
660	4-20-71	Antietam Fm.	Quartzite	12	.02	.01	----	----	----	----	----
662	4-20-71	Chickies Fm.	do.	9.2	.10	.04	----	----	----	----	----
664	4-20-71	Antietam Fm.	do.	12	.01	.00	----	----	----	----	----
666	4-20-71	Vintage Fm.	Dolomite	9.9	.73	.09	----	----	----	----	----
668	4-22-71	Conestoga Fm.	Limestone	10	.25	.02	.00	.00	.00	1.5	----
670	4-22-71	Kinzers Fm.	Limestone	15	.04	.00	----	----	----	----	----
672	4-22-71	Chickies Fm.	Slate	14	2.5	.13	----	----	----	----	----
674	4-23-71	Harpers Fm.	Phyllite	19	.06	.17	----	----	----	----	----
676	4-23-71	Kinzers Fm.	Limestone	13	----	----	----	----	----	----	----
678	4-23-71	Marburg Schist	Schist	8.4	.10	.03	.00	.00	.00	.03	----
680	4-23-71	Harpers Fm.	Phyllite	15	.03	.01	.00	.00	.00	.05	----
682	4-26-71	Chickies Fm.	Quartzite	8.0	.10	.02	----	----	----	----	----
684	4-26-71	do.	Slate	10	1.2	.60	----	----	----	----	----
688	4-26-71	Conestoga Fm.	Limestone	18	.06	.00	.00	.00	.00	.10	----
691	12- 3-70	Marburg Schist	Schist	4.7	8.4	.08	----	----	----	----	----
707	10-14-70	do.	do.	8.3	.50	.09	.00	.00	.00	.02	----
723	12- 3-70	do.	do.	7.4	1.1	.18	----	----	----	----	----
725	4-27-71	Ledger Fm.	Dolomite	7.3	.50	.01	----	----	----	----	----

[a]Commercial analysis

(CONTINUED)

Nickel (Ni)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO4)	Chloride (Cl)	Nitrate (NO3)	Fluoride (F)	Phosphate (PO4)	Sum of dissolved constituents	Hardness as $CaCO_3$		Well number
												Calcium, magnesium	Non-carbonate	
----	4.8	3.8	3.3	6.4	9	1.8	9.8	25	.0	.00	65	28	24	Yo-596
----	3.8	2.9	2.6	6.4	10	2.2	6.7	26	.0	.00	59	22	14	
----	16	8.3	12	2.0	19	8.0	29	51	.0	.02	148	74	59	608
.01	57	6.0	4.3	1.6	119	13	14	47	.1	.04	210	160	70	612
----	16	1.0	1.0	.3	11	.0	1.3	1.7	.0	.11	18	8	0	618
----	4.8	5.6	3.5	1.0	7	.0	7.4	40	.0	.00	71	35	30	622
----	24	2.5	16	.7	93	16	8.8	7.5	.1	.00	131	71	0	626
----	13	4.3	5.0	2.2	27	14	9.8	18	.1	.03	95	50	28	628
----	52	3.0	4.6	1.9	130	21	9.6	16	.1	.03	182	142	86	633
----	2.0	1.5	1.5	7.8	8	.6	8.5	10	.0	.00	40	---	---	634
----	3.2	3.5	3.3	1.3	9	.0	6.8	21	.0	.00	52	23	15	636
----	3.7	3.5	6.0	.9	5	9.4	6.5	12	.1	.02	51	24	20	638
----	38	3.2	20	3.4	111	27	18	19	.1	.04	200	108	17	640
----	59	6.6	5.0	3.2	178	29	6.0	16	.3	.17	225	174	28	642
----	13	12	14	8.8	3	16	25	88	.1	.01	---	82	80	644
----	2.7	.9	3.5	15	28	5.2	3.0	.0	.1	.01	55	10	0	646
----	10	5.6	6.8	3.2	10	25	11	18	.1	.01	101	48	40	648
----	2.9	3.9	4.2	1.2	6	4.0	4.7	14	.1	.01	45	23	20	650
----	1.3	1.3	3.5	.7	4	2.0	2.3	7	.1	.01	---	8	5	652
----	35	15	4.7	1.3	105	32	14	25	.0	.02	185	149	63	654
----	22	2.0	3.0	1.0	12	5.0	2.4	2.8	.0	.00	32	14	4	656
----	10	2.0	13	1.8	24	7.7	14	25	.1	.11	105	33	14	658
----	18	4.4	9.4	11	35	32	13	14	.1	.04	131	51	22	660
----	8.6	11	4.9	4.8	0	53	17	12	.6	.00	---	66	66	662
----	24	8.0	5.7	1.9	68	10	10	26	.1	.17	---	93	38	664
----	69	15	42	7.3	236	24	66	17	.2	.00	367	261	68	666
----	90	13	7.0	.8	241	63	11	7.8	.1	.00	322	278	81	668
----	70	6.7	25	3.6	157	42	47	14	.1	.16	303	202	74	670
----	11	8.0	8.7	.4	91	10	1.9	0	.2	.00	---	60	---	672
----	30	7.9	4.7	1.1	128	11	.8	.0	.3	.01	138	108	25	674
----	152	29	17	16	345	95	34	154	.3	.27	---	498	216	676
----	12	5.9	6.5	1.0	11	28	9.4	17	.0	.00	---	58	50	678
----	35	9.0	10	1.6	18	56	32	26	.1	.02	194	125	110	680
----	8.0	2.2	4.7	5.1	2	20	7.8	9.2	.1	.00	65	29	28	682
----	2.5	5.6	2.8	.4	28	12	.9	.0	.2	.00	48	29	6	684
----	93	17	14	3.7	209	53	51	30	.1	.04	383	302	131	688
----	9.8	4.6	2.5	.4	38	9.9	3.2	6.8	.0	.00	56	44	13	691
----	11	1.8	3.3	.9	20	6.0	5.9	12	.0	.01	---	35	19	707
----	4.0	1.5	2.2	.5	24	.5	2.8	5.4	.0	.00	36	16	0	723
----	80	29	8.4	1.3	259	78	20	21	.1	.01	373	319	107	725

TOPOGRAPHIC AND GEOLOGIC SURVEY
Arthur A. Socolow, *State Geologist*

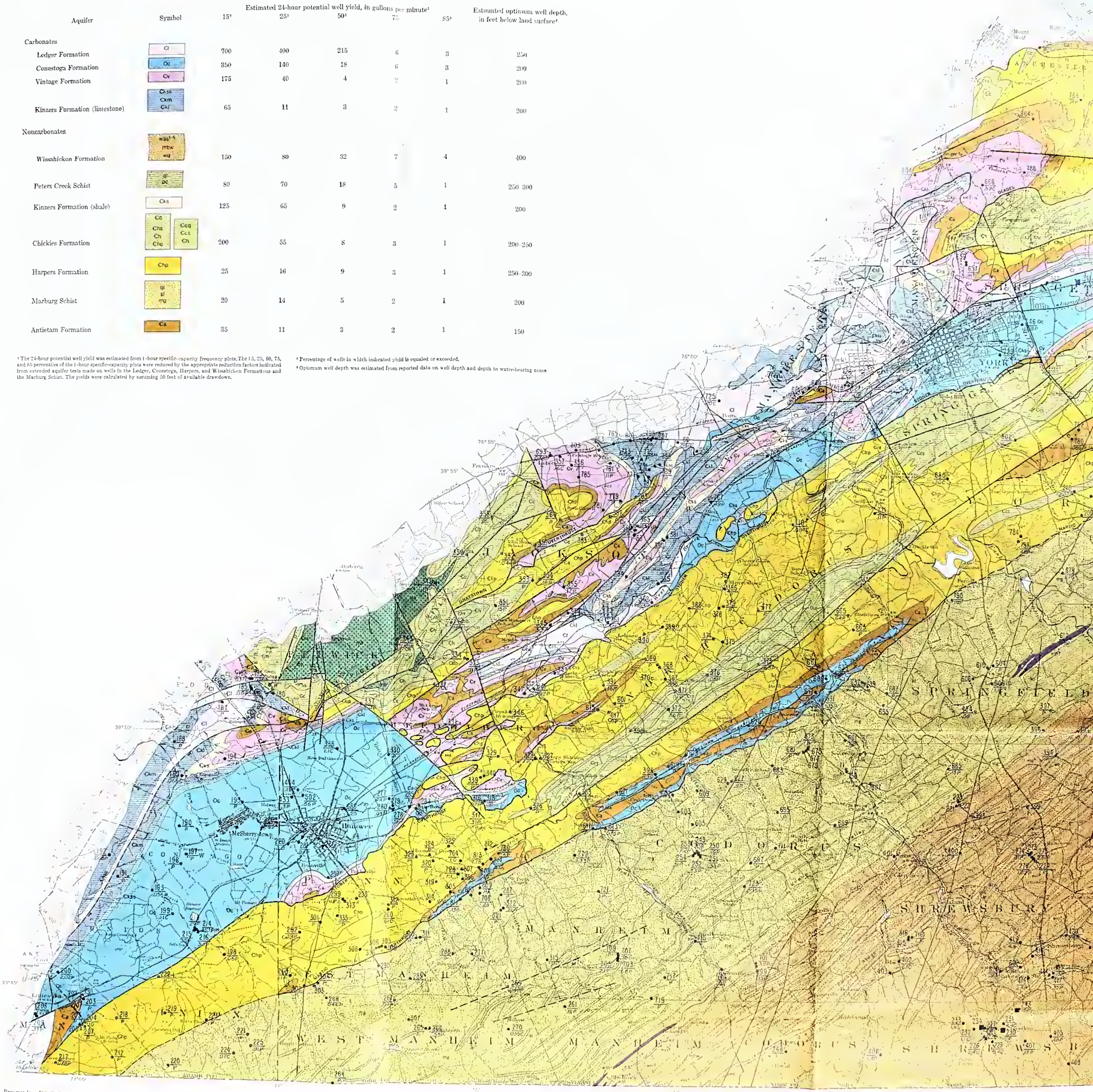
MAJOR CARBONATE AND NONCARBONATE AQUIFERS ARRANGED IN ORDER OF DECREASING YIELD POTENTIAL

Aquifer	Symbol	Estimated 24-hour potential well yield, in gallons per minute[1] 15[2]	25[2]	50[2]	75[2]	85[2]	Estimated optimum well depth, in feet below land surface[3]
Carbonates							
Ledger Formation	Cl	700	400	215	6	3	250
Conestoga Formation	Oc	350	140	18	6	3	200
Vintage Formation	Cv	175	40	4	2	1	200
Kinzers Formation (limestone)	Ckss, Ckm, Ckl	65	11	3	2	1	200
Noncarbonates							
Wissahickon Formation	was[1-6], mbw, wq	150	80	32	7	4	400
Peters Creek Schist	qt, pc	80	70	18	5	1	250–300
Kinzers Formation (shale)	Cks	125	65	9	2	1	200
Chickies Formation	Cc, Chs, Ch, Chc; Ccq, Ccs, Ch	200	55	8	3	1	200–250
Harpers Formation	Chp	25	16	9	3	1	250–300
Marburg Schist	qt, sl, mg	20	14	5	2	1	200
Antietam Formation	Ca	35	11	3	2	1	150

[1] The 24-hour potential well yield was estimated from 1-hour specific-capacity frequency plots. The 15, 25, 50, 75, and 85 percentiles of the 1-hour specific-capacity plots were reduced by the appropriate reduction factors indicated from extended aquifer tests made on wells in the Ledger, Conestoga, Harpers, and Wissahickon Formations and the Marburg Schist. The yields were calculated by assuming 50 feet of available drawdown.

[2] Percentage of wells in which indicated yield is equaled or exceeded.

[3] Optimum well depth was estimated from reported data on well depth and depth to water-bearing zones.



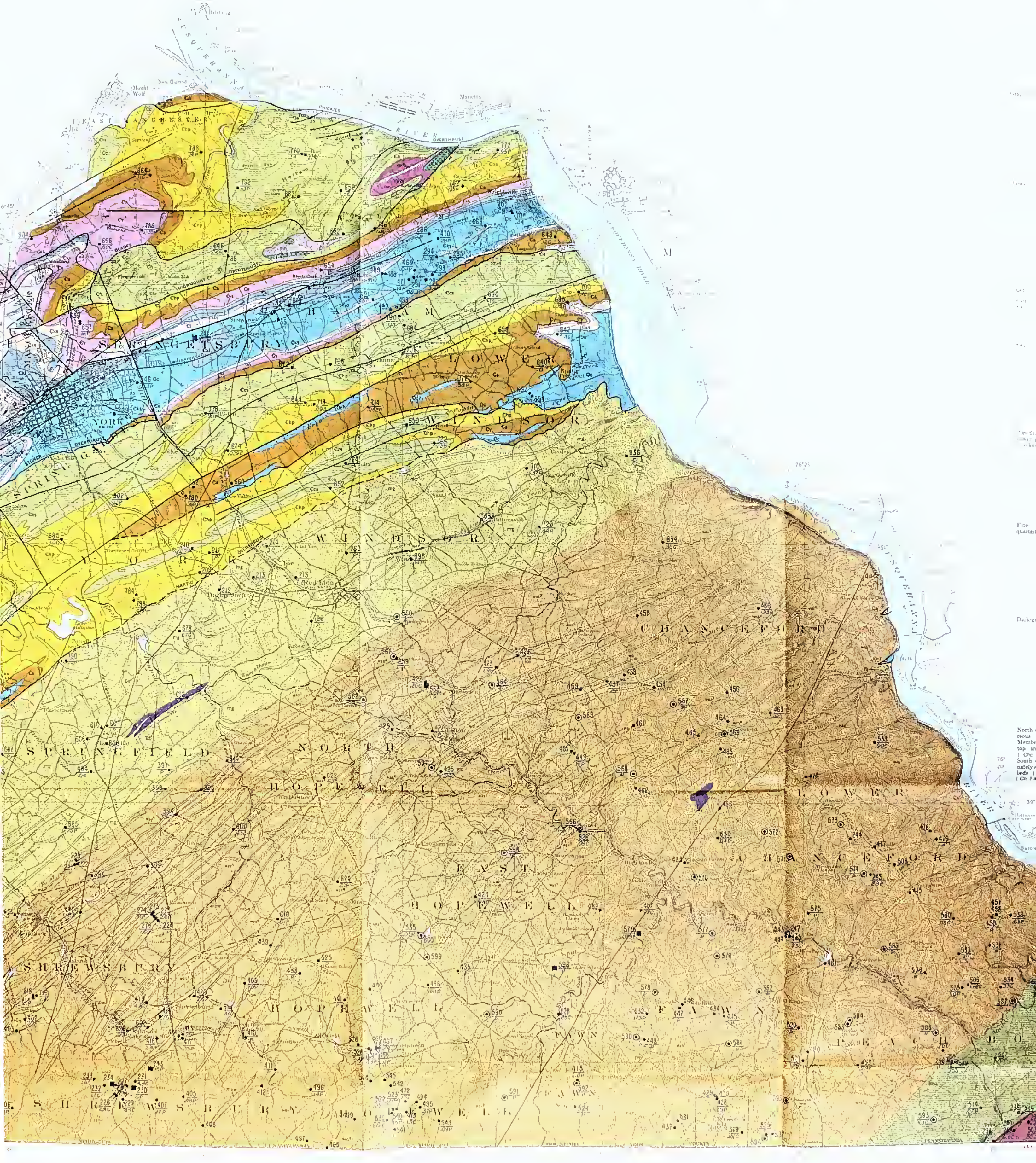
Base map from U.S. Geological Survey Carlisle, New Cumberland, Middletown, Hanover, York, and McCalls Ferry 15-minute quadrangles

Note: The topographic maps were surveyed in or before 1910. The Holtwood, Safe Harbor, and Conowingo dams have been constructed since the topographic maps were surveyed, and the shorelines and islands have not been adjusted to the new levels of the water ponded above these dams. Some of the alluvium mapped along the shores and on the islands is now submerged.

GEOLOGIC AND HYDROLOGIC MAP OF CENTRAL AND

HYDROLOGY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

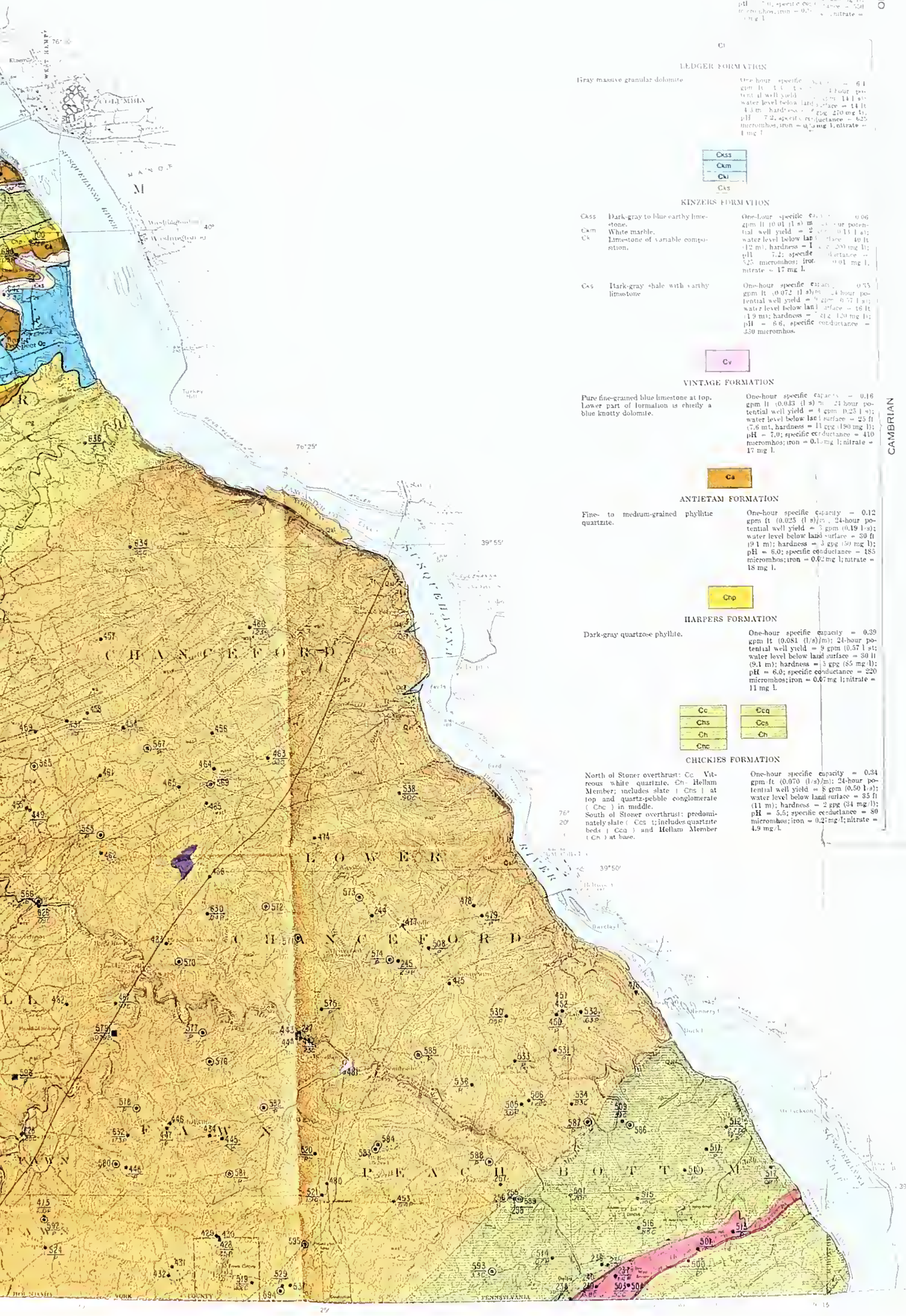


MAP OF CENTRAL AND SOUTHERN YORK COUNTY AND SOUTHEASTERN ADAMS COUNTY, PENNSYLVANIA

HYDROLOGY BY ORVILLE B. LLOYD, JR., AND DOUGLAS J. GROWITZ

1977

YORK COUNTY GEOLOGY FROM STOSE AND JONAS (1939); ADAMS COUNTY GEOLOGY FROM STOSE AND STOSE (1944)



SOUTHEASTERN ADAMS COUNTY, PENNSYLVANIA

OWITZ

AND STOSE (1944)

EXPLANATION

GEOLOGY — HYDROLOGY[2]

NORTH OF MARTIC OVERTHRUST

ORDOVICIAN

Oc

CONESTOGA FORMATION

Gray limestone, argillaceous in places.

One-hour specific capacity = 1.3 gpm/ft (0.27 (l/s)/m); 24-hour potential well yield = ... gpm (1.1 l/s); water level below land surface = 15 ft (4.6 m); hardness = 1... gpg (...20 mg/l); pH = 7.0; specific conductance = 550 micromhos; iron = 0.... mg/l; nitrate = ... mg/l.

CAMBRIAN

Cl

LEDGER FORMATION

Gray massive granular dolomite.

One-hour specific capacity = 6.1 gpm/ft (1.3 (l/s)/m); 24-hour potential well yield = ... gpm (14 l/s); water level below land surface = 14 ft (4.3 m); hardness = ... gpg (270 mg/l); pH = 7.2; specific conductance = 625 micromhos; iron = 0.... mg/l; nitrate = 1 mg/l.

Ckss, Ckm, Ckl, Cks

KINZERS FORMATION

Ckss — Dark-gray to blue earthy limestone.
Ckm — White marble.
Ckl — Limestone of variable composition.

One-hour specific capacity = 0.06 gpm/ft (0.01 (l/s)/m); 24-hour potential well yield = 2 gpm (0.13 l/s); water level below land surface = 40 ft (12 m); hardness = 1... gpg (200 mg/l); pH = 7.2; specific conductance = 525 micromhos; iron = 0.01 mg/l; nitrate = 17 mg/l.

Cks — Dark-gray shale with earthy limestone.

One-hour specific capacity = 0.35 gpm/ft (0.072 (l/s)/m); 24-hour potential well yield = 9 gpm (0.57 l/s); water level below land surface = 16 ft (4.9 m); hardness = 7 gpg (120 mg/l); pH = 6.6; specific conductance = 330 micromhos.

Cv

VINTAGE FORMATION

Pure fine-grained blue limestone at top. Lower part of formation is chiefly a blue knotty dolomite.

One-hour specific capacity = 0.16 gpm/ft (0.033 (l/s)/m); 24-hour potential well yield = 4 gpm (0.25 l/s); water level below land surface = 25 ft (7.6 m); hardness = 11 gpg (190 mg/l); pH = 7.0; specific conductance = 410 micromhos; iron = 0.1... mg/l; nitrate = 17 mg/l.

Ca

ANTIETAM FORMATION

Fine- to medium-grained phyllitic quartzite.

One-hour specific capacity = 0.12 gpm/ft (0.025 (l/s)/m); 24-hour potential well yield = 3 gpm (0.19 l/s); water level below land surface = 30 ft (9.1 m); hardness = 3 gpg (50 mg/l); pH = 6.0; specific conductance = 185 micromhos; iron = 0.02 mg/l; nitrate = 18 mg/l.

Chp

HARPERS FORMATION

Dark-gray quartzose phyllite.

One-hour specific capacity = 0.39 gpm/ft (0.081 (l/s)/m); 24-hour potential well yield = 9 gpm (0.57 l/s); water level below land surface = 30 ft (9.1 m); hardness = 5 gpg (85 mg/l); pH = 6.0; specific conductance = 220 micromhos; iron = 0.07 mg/l; nitrate = 11 mg/l.

Cc, Chs, Ch, Chc — Ccq, Ccs, Ch

CHICKIES FORMATION

North of Stoner overthrust: Cc — Vitreous white quartzite. Ch — Hellam Member; includes slate (Chs) at top and quartz-pebble conglomerate (Chc) in middle.
South of Stoner overthrust: predominately slate (Ccs); includes quartzite beds (Ccq) and Hellam Member (Ch) at base.

One-hour specific capacity = 0.34 gpm/ft (0.070 (l/s)/m); 24-hour potential well yield = 8 gpm (0.50 l/s); water level below land surface = 35 ft (11 m); hardness = 2 gpg (34 mg/l); pH = 5.5; specific conductance = 80 micromhos; iron = 0.27 mg/l; nitrate = 4.9 mg/l.

GEOLOGY[1] — HYDROLOGY[2]

PRECAMBRIAN

mb

METABASALT

Grayish-green to bluish-gray hornblende schist ... with green epidote.

Not studied.

vs

VOLCANIC SLATE

Blue and dark purple sericitic slate, in part amygdaloidal and fragmental.

Not studied.

mrb, mrh

METARHYOLITE

Zone of brecciated pink rhyolite with glassy quartz and ilmenite (mrb).

Not studied.

SOUTH OF MARTIC OVERTHRUST

PROBABLY LOWER PALEOZOIC

pb

PEACH BOTTOM SLATE

Blue-black slate, finely lustrous on cleavage surfaces.

One-hour specific capacity = 1.4 gpm/ft (0.29 (l/s)/m); water level below land surface = 53 ft (16 m); hardness = 1.5 gpg (25 mg/l); pH = 6.2; specific conductance = 70 micromhos.

cl

CARDIFF CONGLOMERATE

Greenish-gray quartz conglomerate with muscovite partings.

Not studied.

sp

SERPENTINITE AND ACTINOLITE SCHIST

Serpentinite is dark green and mottled with light-green serpentine. Actinolite schist is composed of fine-grained talc flakes and scanty chlorite.

Not studied.

qt, pc

PETERS CREEK SCHIST

Includes muscovite schist and prominent quartzite layers (qt).

One-hour specific capacity = 0.70 gpm/ft (0.14 (l/s)/m); 24-hour potential well yield = 18 gpm (1.1 l/s); water level below land surface = 35 ft (11 m); hardness = 2 gpg (34 mg/l); pH = 5.7; specific conductance = 117 micromhos; iron = 2.0 mg/l; nitrate = 22 mg/l.

was1, was2, was3, was4, was5, wq, mbw

WISSAHICKON FORMATION

Includes various types of crystalline schists: was1 — coarse-grained sparkling muscovite-chlorite-quartz schist; was2 — albite-muscovite-chlorite-quartz schist; was3 — blue-green albite-chlorite-muscovite-quartz schist; was4 — fine-grained chlorite-muscovite-quartz schist; was5 — chloritoid schist. wq — quartzite. mbw — infolded metabasalt.

One-hour specific capacity = 0.95 gpm/ft (0.20 (l/s)/m); 24-hour potential well yield = 32 gpm (2.0 l/s); water level below land surface = 29 ft (8.8 m); hardness = 2 gpg (34 mg/l); pH = 5.9; specific conductance = 125 micromhos; iron = 0.08 mg/l; nitrate = 28 mg/l.

qt, sl, mg

MARBURG SCHIST

Bluish-gray to silvery-green fine-grained schist, containing muscovite, chlorite, albite or chloritoid, and quartz. Includes slate beds (sl) and quartzite (qt) at top.

One-hour specific capacity = 0.28 gpm/ft (0.058 (l/s)/m); 24-hour potential well yield = 5 gpm (0.32 l/s); water level below land surface = 29 ft (8.8 m); hardness = 3 gpg (50 mg/l); pH = 6.0; specific conductance = 130 micromhos; iron = 0.17 mg/l; nitrate = 13 mg/l.

wm

WAKEFIELD MARBLE

Blue thin-bedded crystalline limestone with argillaceous bands and greenish medium-grained calcareous schist.

One well inventoried.

[1] Qal, Quaternary alluvium; Qt, Quaternary low terrace gravels; Tt, Tertiary high terrace gravels; and Trd, Triassic diabase dikes are of small areal extent and were not studied or, except for Trd, differentiated by color. Ages taken from *Geologic Map of Pennsylvania* (Gray and others, 1960).

[2] All numbers in hydrologic description are median values.

Trd

TRIASSIC DIKE

SYMBOLS

Contact
Dashed where approximately located.

D
High-angle fault
D, downthrown side. Dashed where uncertain.

T
Thrust fault
T on overthrust side. Dashed where uncertain.

Overturned — Inclined — Crumpled
Strike and dip of beds

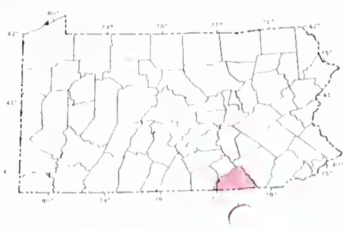
• $\frac{473}{15C}$ or P

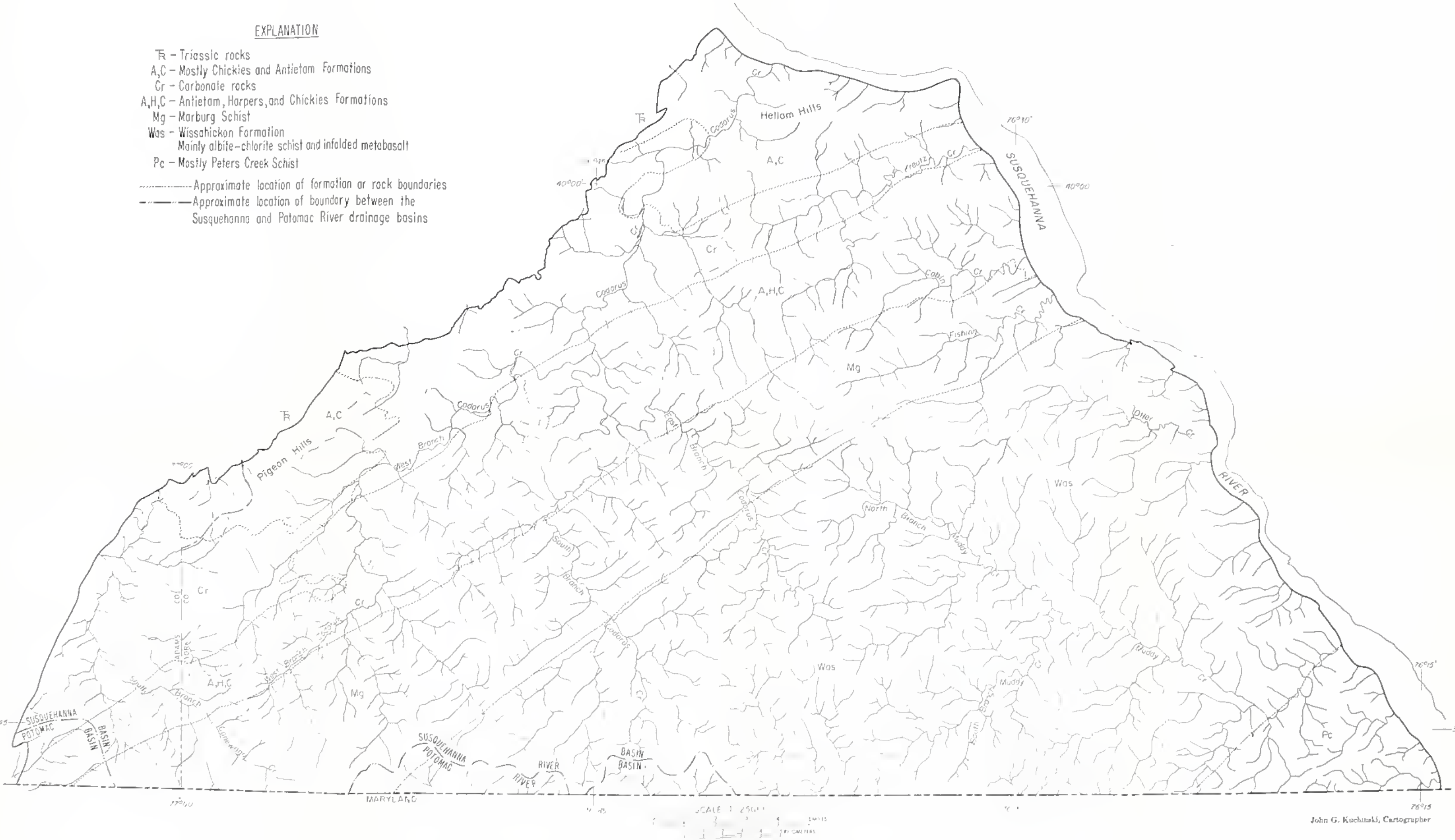
Dot represents well location. Number above horizontal line is county well number. Number below the line, where present, is the 1-hour specific capacity of the well in gallons per minute per foot of drawdown; C, where present, indicates that complete chemical analysis data are available in Table 18. P, where present, shows that partial chemical information is available in Table 17.

Monthly water level observations made in well during investigation. Water-level data in U.S. Geological Survey files in Harrisburg, Pa.

Continuous water level observations made in well during investigation. Water level data in U.S. Geological Survey files in Harrisburg, Pa.

Albert E. Vantilden, Cartographer





DRAINAGE AND SELECTED GENERAL GEOLOGY IN CENTRAL AND SOUTHERN YORK COUNTY AND SOUTHEASTERN ADAMS COUNTY, PENNSYLVANIA